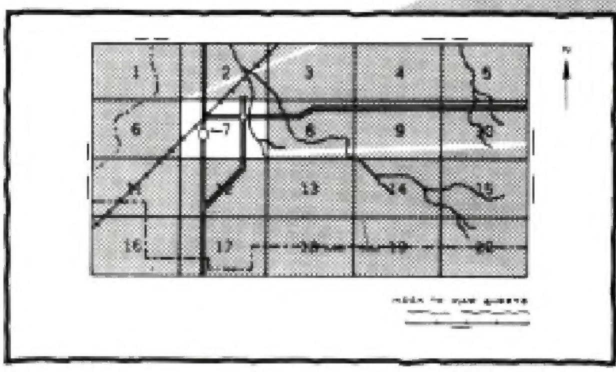
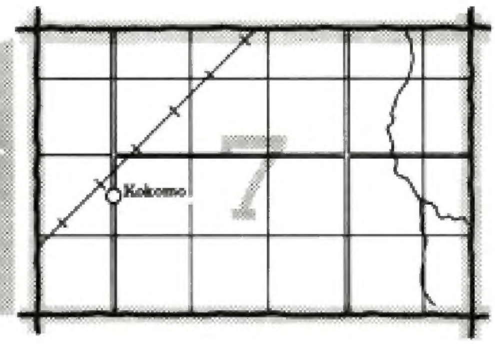
SOIL SURVEY OF
HIDALGO COUNTY, TEXAS

United States Department of Agriculture, Soil Conservation Service
in cooperation with the Texas Agricultural Experiment Station

HOW TO USE

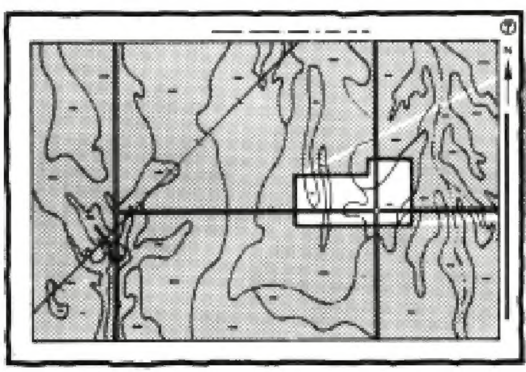
1. Locate your area of interest on the "Index to Map Sheets"

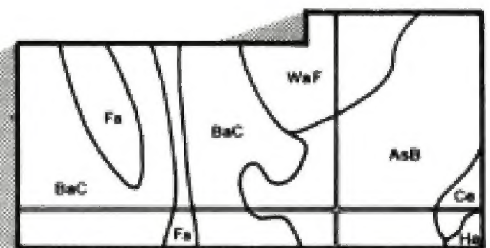




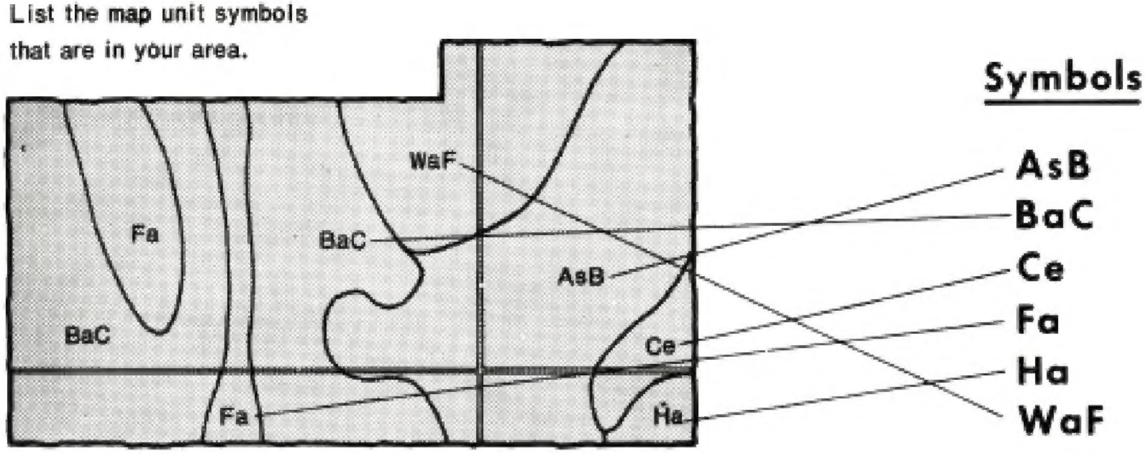
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



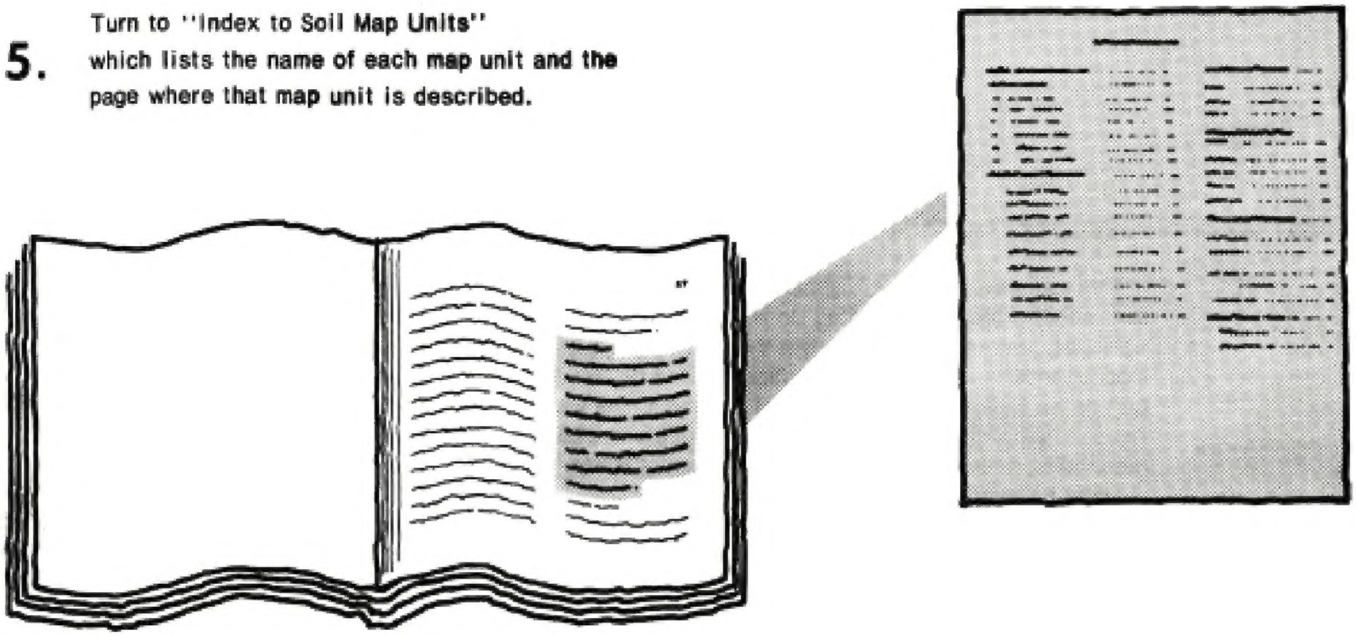


4. List the map unit symbols that are in your area.

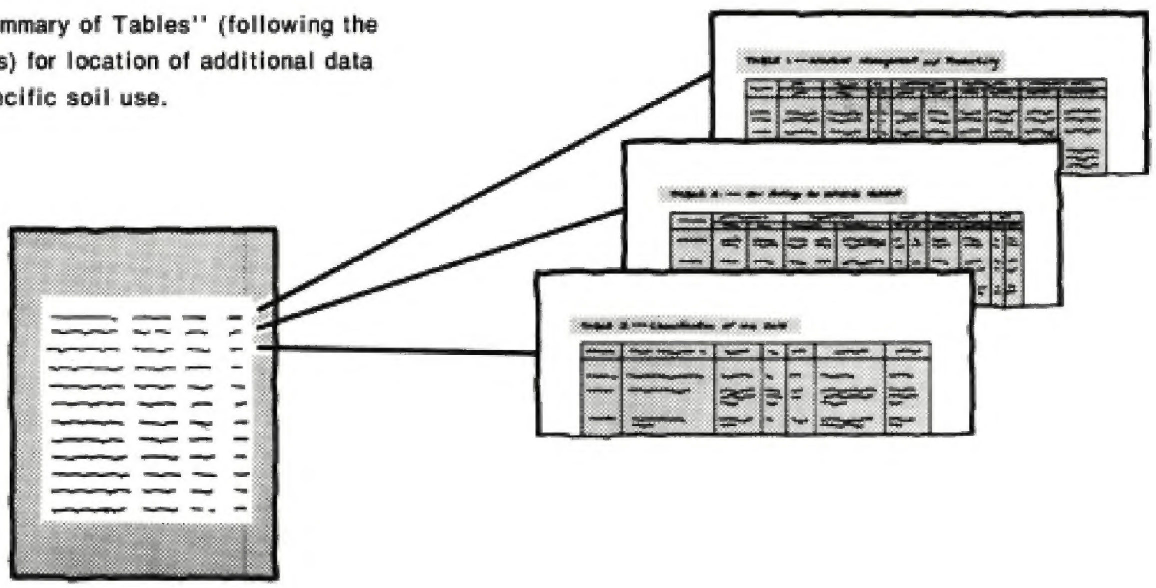


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1970-78. Soil names and descriptions were approved in 1979. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1978. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Hidalgo Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Irrigated citrus on Hidalgo sandy clay loam, 0 to 1 percent slopes.

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soil series

Issued June 1981

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foreword

This soil survey contains information that can be used in land-planning programs in Hidalgo County, Texas. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

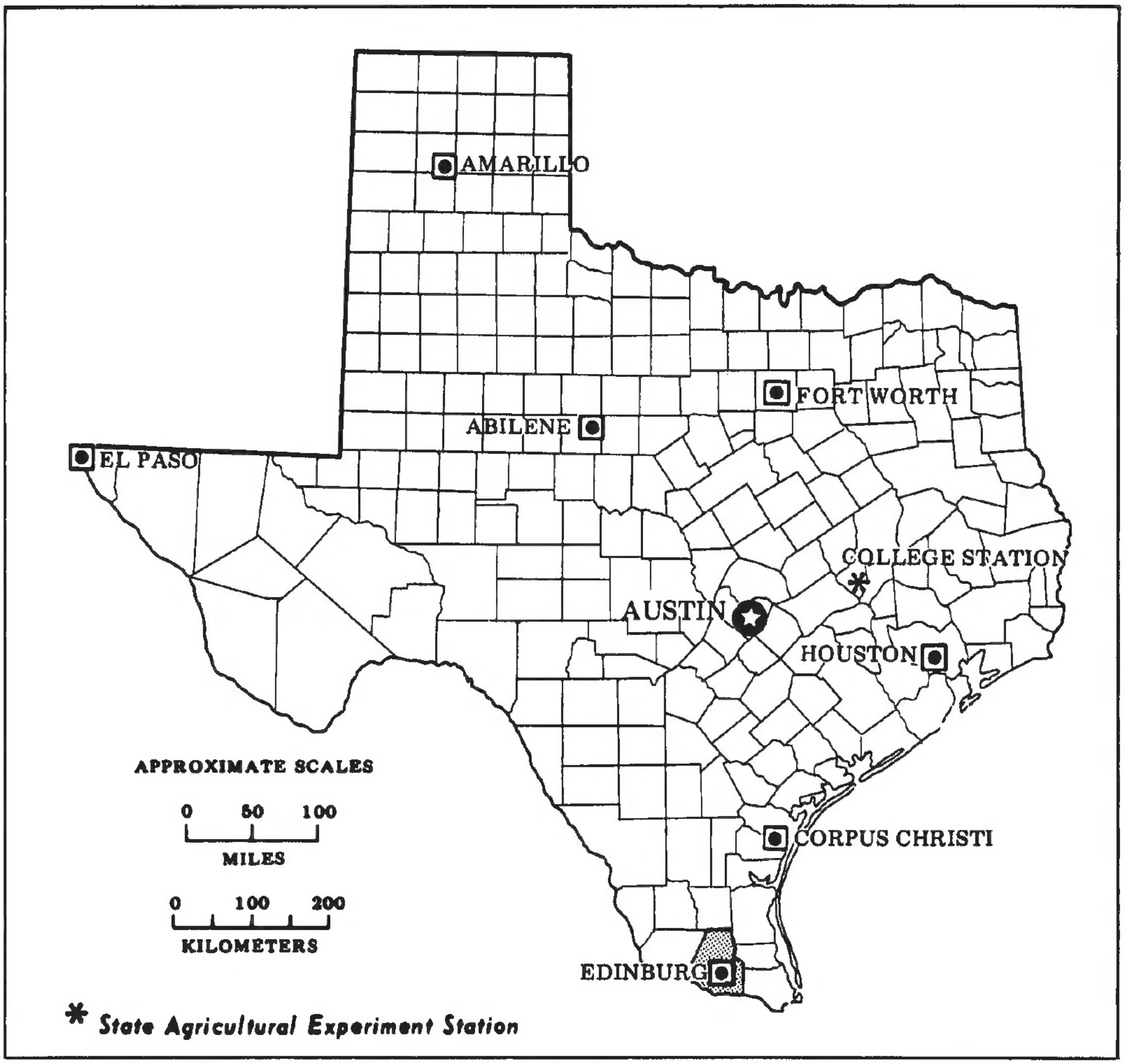
This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to cemented pan. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

George C. Marks

George C. Marks
State Conservationist
Soil Conservation Service



Location of Hidalgo County in Texas.

soil survey of
Hidalgo County, Texas

By Jerry L. Jacobs, Soil Conservation Service

Fieldwork by Jerry L. Jacobs, Gerald A. McMasters and Harold W. Hyde,
Soil Conservation Service
Levi Steptoe, Jr., Fred E. Minzenmayer, DeWayne Williams, and Charles M. Thompson,
Soil Conservation Service, assisted in field mapping

United States Department of Agriculture, Soil Conservation Service
in cooperation with the Texas Agricultural Experiment Station

HIDALGO COUNTY is in the extreme southern part of Texas. The county is separated from the Republic of Mexico by the Rio Grande.

Edinburg is the county seat. In 1978 the population of the county was about 239,000. Hidalgo County is a leading Texas county for citrus and vegetable production and related agribusiness.

The county is irregular in shape, measuring about 55 miles from north to south and about 50 miles from east to west at the widest point. It covers 1,555 square miles, or 995,200 acres. The land surface is nearly level to gently sloping. The elevation rises from 40 feet above sea level on the eastern side to 375 feet on the western side. Generally, drainage is in a northeastern direction. However, in the area around La Joya Creek in the southwestern part of the county, drainage is to the south, and on the Rio Grande flood plain, drainage is to the east. The sandy area in the northern part of the county has little or no drainage pattern.

In 1978 about 43 percent of the county was irrigated cropland, about 29 percent rangeland, about 15 percent nonirrigated cropland, about 7 percent urban areas, and about 6 percent pasture. The irrigated cropland is intensely farmed and highly specialized. Cotton, citrus, vegetables, grain sorghum, and sugarcane are grown on most of the irrigated cropland.

Hidalgo County is in the southernmost part of the Rio Grande Plain Land Resource Area. Many of the soils in the county formed in sediments deposited by the Rio Grande. These sediments are mostly clay and sand; there are some silt deposits near the river. The Gulf of Mexico may have been the origin of the sandy soils in the northern part of the county. Drainage and salinity are the main agricultural management problems with the soils of the county. The nearly level soils are often seasonally wet, and adequate drainage outlets are needed for high crop production. Irrigation water from the Rio Grande has been a source of toxic salts to the soils.

A soil survey of Hidalgo County was published in 1929 (*15*). The present survey updates the earlier survey and provides additional information and larger maps that show the soils in greater detail.

Descriptions, names, and delineations of soils in this soil survey do not fully agree with those on soil maps for adjacent counties. Differences are the result of more knowledge of soils, modifications in series concepts, intensity of mapping, or the extent of soils within the survey.

general nature of the county

This section provides information about the natural resources, climate, transportation, industry, and history of Hidalgo County.

natural resources

Hidalgo County's most valuable resources are soil, water, natural gas, and a mild climate. Also present are

strata of sand, gravel, and caliche that are good for building materials. The proximity of the Gulf of Mexico, 35 miles to the east, and the Rio Grande has had a definite influence on these natural resources and their uses.

Because the underground water supply is too saline for practical use, the Rio Grande is a valuable source of water. Much of the river's water is impounded behind Falcon Dam. This dam is about 40 miles upstream from Hidalgo County. Water from Falcon Lake is released for use by both agricultural and urban areas.

climate

Prepared by the National Climatic Center, Asheville, N.C.

Table 1 gives data on temperature and precipitation for the survey area as recorded at McAllen, Tex., from 1951 to 1975. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 61 degrees F, and the average daily minimum temperature is 50 degrees. The lowest temperature on record, which occurred at McAllen on January 12, 1962, is 17 degrees. In summer the average temperature is 84 degrees, and the average daily maximum temperature is 95 degrees. The highest recorded temperature, which occurred at McAllen on May 12, 1964, is 106 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 23 inches. Of this, 14 inches, or 60 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 8 inches. The heaviest 1-day rainfall during the period of record was 6.1 inches at McAllen on April 9, 1954. Thunderstorms occur on about 25 days each year, and most occur in summer.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 90 percent. The sun shines 80 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the southeast. Average windspeed is highest, 14 miles per hour, in spring.

transportation

Highways are important to Hidalgo County; most of the agricultural products are transported by trucks as far north as Canada. The major artery for highway traffic is U.S. Highway 281, which connects Hidalgo County with cities to the north. Also important is U.S. Highway 83, which traverses Hidalgo County from the east to points in the northwest. Hidalgo County has an extensive network of state and farm-to-market highways.

Two bridges over the Rio Grande are ports of entry to Mexico. Two major rail systems serve Hidalgo County.

Major airlines serve this part of Texas from airports in McAllen and also from Harlingen and Brownsville.

Citrus fruits from Hidalgo County are trucked to Brownsville and shipped from there to Europe and Asia.

Industry

Most of the industry in Hidalgo County is related to agriculture. It includes fruit and vegetable processors, packers, agribusinesses, and clothing manufacturers. Some industry is petroleum-related.

The McAllen-Edinburg-Pharr area is the eighth largest metropolitan area in Texas. It has 134 manufacturing plants. The mild, semitropical climate influences both agricultural production and tourist trade. McAllen, the largest city in Hidalgo County, is a tourist center and a port of entry to Mexico.

Many areas that were once cropland and citrus orchards have been converted to residential areas. Most of the residential units are single family homes, but many apartment buildings have been constructed recently.

Soils in the southern two-thirds of the county are generally flat and fertile. Citrus, vegetables, cotton, grain sorghum, and sugarcane are important crops. The northern one-third of the county has slightly undulating sandy soils and some shallow soils. These soils are used mostly as rangeland and pastureland.

history

Hidalgo County was established in 1852 from parts of Cameron and Starr Counties. In 1911 parts of the original county were included in Brooks and Willacy Counties, and in 1921 the county was again reorganized to form its present boundaries (*15*). The county was named after Miguel Hidalgo y Costilla, liberator of the Republic of Mexico from Spain (*6*).

The main factor in the development of this area was the use of irrigation water from the Rio Grande. In 1889 this use was started by John Closner, and by the early 1900's land developers promoted this part of Texas for agricultural production. Since then, emphasis has been on marketing and distributing the agricultural products. Today, citrus production totals 16 to 18 million boxes annually. The county produces more vegetables than any other county in the state. Almost a million tons of sugarcane are produced each year. A sugar refinery is about 20 miles east of Edinburg.

how this survey was made

Soil scientists made this survey to learn what soils are in the county, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The soils in Hidalgo County vary widely in their potential for major land uses. Table 4 shows the extent of the map units shown on the general soil map. It lists the potential of each, in relation to that of the other map units, for major land uses and shows soil properties that limit use.

Each map unit is rated for *cultivated crops—irrigated and nonirrigated, citrus, vegetables, rangeland* and *urban uses* . Cultivated crops and vegetables are those grown extensively in the county. Citrus are mainly oranges and grapefruit. Rangeland refers to areas of native vegetation—grasses, forbs, woody plants, and some introduced grains. Urban uses include residential, commercial, and industrial areas.

soil descriptions

Hidalgo County has 6 broad areas of soils that include 13 general soil map units. Descriptions of these areas and the soils within these general map units follow.

Dominantly nearly level to gently sloping loamy soils; on uplands

Map units 1 through 6 make up about 59 percent of the county. The major soils are mainly deep, well drained, moderately permeable, and loamy throughout. They are on a nearly level to gently sloping upland plain. The shrink-swell potential is moderate to low.

These soils are mainly used for nonirrigated and irrigated crops and citrus. A few areas are used for improved pasture or as rangeland.

1. Hidalgo

Deep, moderately permeable soils that typically have a dark grayish brown sandy clay loam surface layer

This map unit consists of nearly level to gently sloping soils on uplands. It occupies about 18 percent of the county. Hidalgo soils make up about 90 percent of the unit. About 78 percent of this unit is Hidalgo sandy clay loam, and about 12 percent is Hidalgo fine sandy loam. Racombes, Raymondville, and Rio soils make up 10 percent of the unit.

Hidalgo soils are on broad uplands.

Hidalgo soils are well drained and moderately permeable. Typically, these soils have a dark grayish brown, sandy clay loam surface layer about 17 inches thick. The subsoil, to a depth of 28 inches, is brown sandy clay loam. From 28 to 38 inches, it is pale brown clay loam. The underlying material to 80 inches is very pale brown clay loam. These soils are calcareous throughout.

Racombes and Raymondville soils are nearly level. They are slightly lower on the landscape than Hidalgo soils. Rio soils are in small, enclosed depressional areas.

Soils in this unit are used mostly as irrigated cropland and for citrus. A few areas are used for improved pasture. Moderate to severe salinity affects about 10 to 15 percent of the acreage in this unit.

This unit has high potential for nonirrigated and irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, citrus, and cool and warm season vegetables.

Potential is high for nonirrigated and irrigated pasture grasses. Coastal bermudagrass, African stargrass, introduced bluestems, and other grasses are suited to this unit.

This unit has high potential for rangeland, but it is not used for this purpose.

Potential is medium for urban uses and high for recreation uses. Shrinking and swelling with moisture changes in the soil and corrosivity to uncoated steel are the main limitations.

2. McAllen-Brennan

Deep, moderately permeable soils that typically have a light brownish gray or dark brown fine sandy loam surface layer

This map unit consists of nearly level to gently sloping soils on uplands (fig. 1). It occupies about 12 percent of the county. McAllen soils make up about 56 percent of the unit; Brennan soils 30 percent; and Cuevitas, Delmita, Ramadero, Randado, Rio, and Tiocano soils 14 percent.

McAllen soils are in slightly lower positions than Brennan soils.

McAllen soils are well drained and moderately permeable. Typically, these soils have a light brownish gray fine sandy loam surface layer about 14 inches thick. The subsoil, to a depth of 37 inches, is pale brown sandy clay loam. The underlying material to 72 inches is very pale brown sandy clay loam. These soils are calcareous throughout.

Brennan soils are well drained and moderately permeable. Typically, these soils have a dark brown fine sandy loam surface layer about 13 inches thick. The subsoil, to a depth of 47 inches, is sandy clay loam. It is brown in the upper part and pale brown in the lower part. The underlying material to 65 inches is very pale brown sandy clay loam. These soils are noncalcareous to a depth of 29 inches.

Cuevitas and Randado soils are in positions similar to those of Brennan soils. Ramadero soils are in slightly depressed drainageways. Rio and Tiocano soils are in small, enclosed depressional areas.

Soils in this unit are used mostly as nonirrigated cropland. A few areas are used as irrigated cropland, rangeland, and for improved pasture.

This unit has medium potential for nonirrigated crops and high potential for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, citrus, and a wide variety of cool and warm season vegetables.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Improved

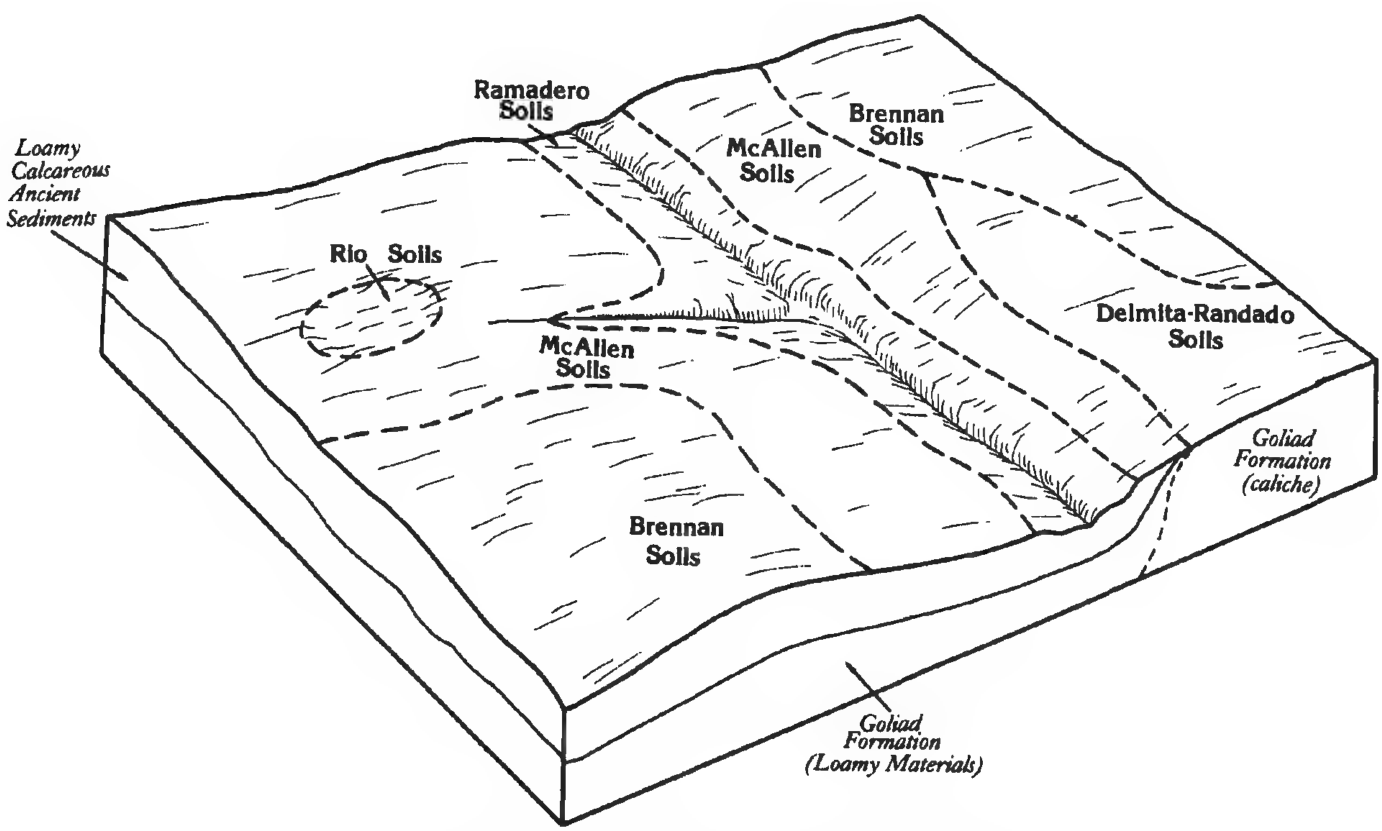


Figure 1.—Pattern of soils in the McAllen-Brennan map unit.

bermudagrass, buffelgrass, introduced bluestems, and other grasses are suited to this unit.

This unit has high potential for rangeland. Climax vegetation is grasses, forbs, and woody plants.

Potential is medium for urban uses and high for recreation uses. The main limitation is shrinking and swelling with moisture changes in the soil.

3. Brennan-Hidalgo

Deep, moderately permeable soils that typically have a dark brown or dark grayish brown fine sandy loam surface layer

This map unit consists of nearly level to gently sloping soils on uplands. It occupies about 11 percent of the county. Brennan soils make up about 43 percent of the unit and Hidalgo soils 42 percent. About 85 percent of the Hidalgo soils have a fine sandy loam surface layer and about 15 percent have a sandy clay loam surface layer. Cuevitas, McAllen, Ramadero, Randado, Rio, and Tiocano soils make up 15 percent.

Brennan soils are on slightly higher positions than the Hidalgo soils.

Brennan soils are well drained and moderately permeable. Typically, these soils have a dark brown fine sandy loam surface layer about 13 inches thick. The subsoil, to a depth of 47 inches, is sandy clay loam. The upper part is brown, and the lower part is pale brown. The underlying material to 65 inches is very pale brown sandy clay loam. These soils are noncalcareous to a depth of 29 inches.

Hidalgo soils are well drained and moderately permeable. Typically, about 85 percent of the Hidalgo soils have a dark grayish brown fine sandy loam surface layer about 15 inches thick. The subsoil, to a depth of 39 inches, is sandy clay loam. It is brown in the upper part and pale brown in the lower part. The underlying material to 72 inches is very pale brown sandy clay loam. These soils are calcareous throughout.

Cuevitas, McAllen, and Randado soils are in positions similar to those of Brennan soils. Ramadero soils are in slightly depressed drainageways. Rio and Tiocano soils are in small, enclosed depressional areas.

Soils in this unit are used mostly as irrigated cropland and for citrus. A few areas are used as nonirrigated cropland and for improved pasture.

This unit has medium potential for nonirrigated crops and a high potential for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, citrus, and cool and warm season vegetables.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Improved bermudagrass, buffelgrass, introduced bluestems, and other grasses are suited to this unit.

This unit has high potential for rangeland, but it is not used for this purpose.

Potential is medium for urban uses and high for recreation uses. The main limitation is the shrinking and swelling of the Hidalgo soils.

4. Willacy-Delfina-Hargill

Deep, moderately and moderately slowly permeable soils that typically have a dark grayish brown, grayish brown, or brown fine sandy loam surface layer

This map unit consists of nearly level to gently sloping soils on uplands. It occupies about 8 percent of the county. Willacy soils make up about 41 percent of the unit; Delfina soils 17 percent; Hargill soils 17 percent; and Hidalgo, Racombes, Rio, and Tiocano soils 25 percent.

Willacy and Hargill soils are in the slightly higher positions, and Delfina soils are in the slightly lower positions.

Willacy soils are well drained and moderately permeable. Typically, these soils have a dark grayish brown fine sandy loam surface layer about 14 inches thick. The subsoil, to a depth of 59 inches, is sandy clay loam. The upper part is dark grayish brown, and the lower part is brown. The underlying material to a depth of 80 inches is pale brown to very pale brown sandy clay loam. These soils are noncalcareous to a depth of 42 inches.

Delfina soils are moderately well drained and moderately slowly permeable. Typically, these soils have a fine sandy loam surface layer about 13 inches thick that is grayish brown in the upper part and brown in the lower part. The subsoil, to a depth of 39 inches, is sandy clay loam mottled in shades of red, brown, and yellow. The upper part is brown, and the lower part is pale brown. The underlying material to 80 inches is pink sandy clay loam. These soils are noncalcareous to 39 inches.

Hargill soils are well drained and moderately permeable. Typically, these soils have a brown fine sandy loam surface layer about 18 inches thick. The subsoil, to a depth of 63 inches, is sandy clay loam. The upper part is reddish brown, and the lower part is yellowish red. The underlying material to 80 inches is reddish yellow sandy clay loam. These soils are noncalcareous to 63 inches.

Hidalgo soils are in slightly lower positions than the Willacy, Delfina, and Hargill soils. Racombes soils are in slightly depressed positions. Rio and Tiocano soils are in small, enclosed depressional areas.

Soils in this unit are used mostly as irrigated and nonirrigated cropland and for citrus. A few areas are used as rangeland and for improved pasture.

This unit has high potential for nonirrigated and irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, citrus, and cool and warm season vegetables.

Potential is high for nonirrigated and irrigated pasture grasses. Improved bermudagrass, buffelgrass, introduced bluestems, and other grasses are suited to this unit.

This unit has high potential for rangeland. Climax vegetation is grasses, forbs, and woody plants.

Potential is medium for urban uses and high for recreation uses. The main limitation is the shrinking and swelling of Delfina soils.

5. Delmita-Randado

Moderately deep and shallow, moderately permeable soils that typically have a reddish brown fine sandy loam or loamy fine sand surface layer

This map unit consists of nearly level to gently sloping soils on uplands. It occupies about 8 percent of the county. Delmita soils make up about 49 percent of the unit and Randado soils about 27 percent. About 60 percent of the Delmita soils have a fine sandy loam surface layer and about 40 percent have a loamy fine sand surface layer. Brennan, Cuevitas, Hebbronville, Rio, and Tiocano soils make up 24 percent of the unit.

Delmita and Randado soils are nearly level to gently sloping.

Delmita soils are moderately deep, well drained and moderately permeable. Typically, about 60 percent of the Delmita soils have a reddish brown fine sandy loam surface layer about 13 inches thick. The subsoil, to a depth of 34 inches, is red sandy clay loam. Indurated caliche is below the subsoil. These soils are noncalcareous above the caliche.

Randado soils are shallow, well drained and moderately permeable. Typically, these soils have a reddish brown fine sandy loam surface layer about 9 inches thick. The subsoil, to a depth of 16 inches, is reddish brown sandy clay loam. Indurated caliche is below the subsoil. These soils are noncalcareous above the caliche.

Brennan and Cuevitas soils are in positions similar to those of Delmita and Randado soils. Hebbronville soils are in slightly higher positions. Rio and Tiocano soils are in small, enclosed depressional areas.

Soils in this unit are used mostly as rangeland and nonirrigated cropland. A few areas are sprinkler irrigated or used for improved pasture. This unit is also used as a source of commercial caliche.

This unit has low potential for nonirrigated crops and medium potential for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, and cool and warm season vegetables.

Potential is low for nonirrigated pasture grasses and medium for irrigated pasture grasses. Improved bermudagrass, blue panicgrass, and other grasses are suited to this unit.

This unit has medium potential for rangeland. Climax vegetation is grasses, forbs, and woody plants.

Potential is medium for urban and recreation uses. The main limitation is the cemented pan or indurated caliche below the surface.

6. Willacy-Racombes

Deep, moderately permeable soils that typically have a dark grayish brown or very dark gray fine sandy loam or sandy clay loam surface layer

This map unit consists of nearly level to gently sloping soils on uplands. It occupies about 2 percent of the county. Willacy soils make up about 44 percent of the unit; Racombes soils 31 percent; and Delfina, Hargill, Hidalgo, Raymondville, Rio, and Tiocano soils 25 percent.

Willacy soils are in the higher positions. Racombes soils are in nearly level, slightly depressed positions.

Willacy soils are well drained and moderately permeable. Typically, these soils have a dark grayish brown fine sandy loam surface layer about 14 inches thick. The subsoil, to a depth of 59 inches, is sandy clay loam. The upper part is dark grayish brown, and the lower part is brown. The underlying material to 80 inches is pale brown and very pale brown sandy clay loam. These soils are noncalcareous to 42 inches.

Racombes soils are moderately well drained and moderately permeable. Typically, these soils have very dark gray sandy clay loam surface layer about 13 inches thick. The subsoil, to a depth of 49 inches, is sandy clay loam. The upper part is dark grayish brown, and the lower part is brown. The underlying material to 72 inches is light brown sandy clay loam. These soils are noncalcareous to 37 inches.

Delfina, Hargill, and Hidalgo soils are in positions similar to those of Willacy soils. Raymondville soils are in positions similar to those of Racombes soils. Rio and Tiocano soils are in small, enclosed depressional areas.

Soils in this unit are used mostly as irrigated cropland and for citrus. A few areas are used for nonirrigated crops and for improved pasture. Moderate to severe salinity affects about 5 to 10 percent of the acreage.

This unit has high potential for nonirrigated and irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, citrus, and cool and warm season vegetables. Although crop yields are high on Racombes soils, occasional loss of crops by flooding is a risk.

Potential is high for nonirrigated and irrigated pasture grasses. Coastal bermudagrass, African stargrass, introduced bluestems, and other grasses are suited to this unit.

This unit has high potential for rangeland, but it is not used for this purpose.

Potential is medium for urban and recreation uses. The Willacy soils have high potential for urban and recreation uses. Because of flooding, the Racombes soils have low potential for urban and recreation uses.

Dominantly nearly level to gently sloping sandy soils; on uplands

Map units 7 and 8 make up about 22 percent of the county. The major soils are deep, moderately well or well drained and moderately slowly to moderately rapidly permeable. These soils are on a nearly level to gently sloping upland eolian plain. Most soils have a sandy surface layer underlain by dense, mottled sandy clay loam. These soils are droughty, and soil blowing is a severe hazard.

Most of these soils are used as rangeland. A few areas are used as nonirrigated cropland and are sprinkler irrigated.

7. Nueces-Sarita

Deep, moderately slowly and moderately rapidly permeable soils that typically have a brown or light brownish gray fine sand surface layer

This map unit consists of nearly level to gently sloping soils on uplands (fig. 2). It occupies about 15 percent of the county. Nueces soils make up about 62 percent of the unit; Sarita soils 26 percent; and Comitas, Falfurrias, Hebbronville, Rio, and Tiocano soils 12 percent.

Nueces soils are in nearly level positions and Sarita soils are in the higher positions.

Nueces soils are moderately well drained and moderately slowly permeable. Typically, these soils have a fine sand surface layer about 29 inches thick. The upper part is brown, and the lower part is light brown. The subsoil, to a depth of 54 inches, is sandy clay loam. The underlying material to 72 inches is very pale brown sandy clay loam. These soils are noncalcareous throughout.

Sarita soils are well drained and moderately rapidly permeable. Typically, these soils have a fine sand surface layer about 48 inches thick. The upper part is light brownish gray, and the lower part is very pale brown. The subsoil, to a depth of 58 inches, is pale brown. It is fine sandy loam in the upper part and sandy clay loam in the lower part. The underlying material to 80 inches is light yellowish brown sandy clay loam. These soils are noncalcareous throughout.

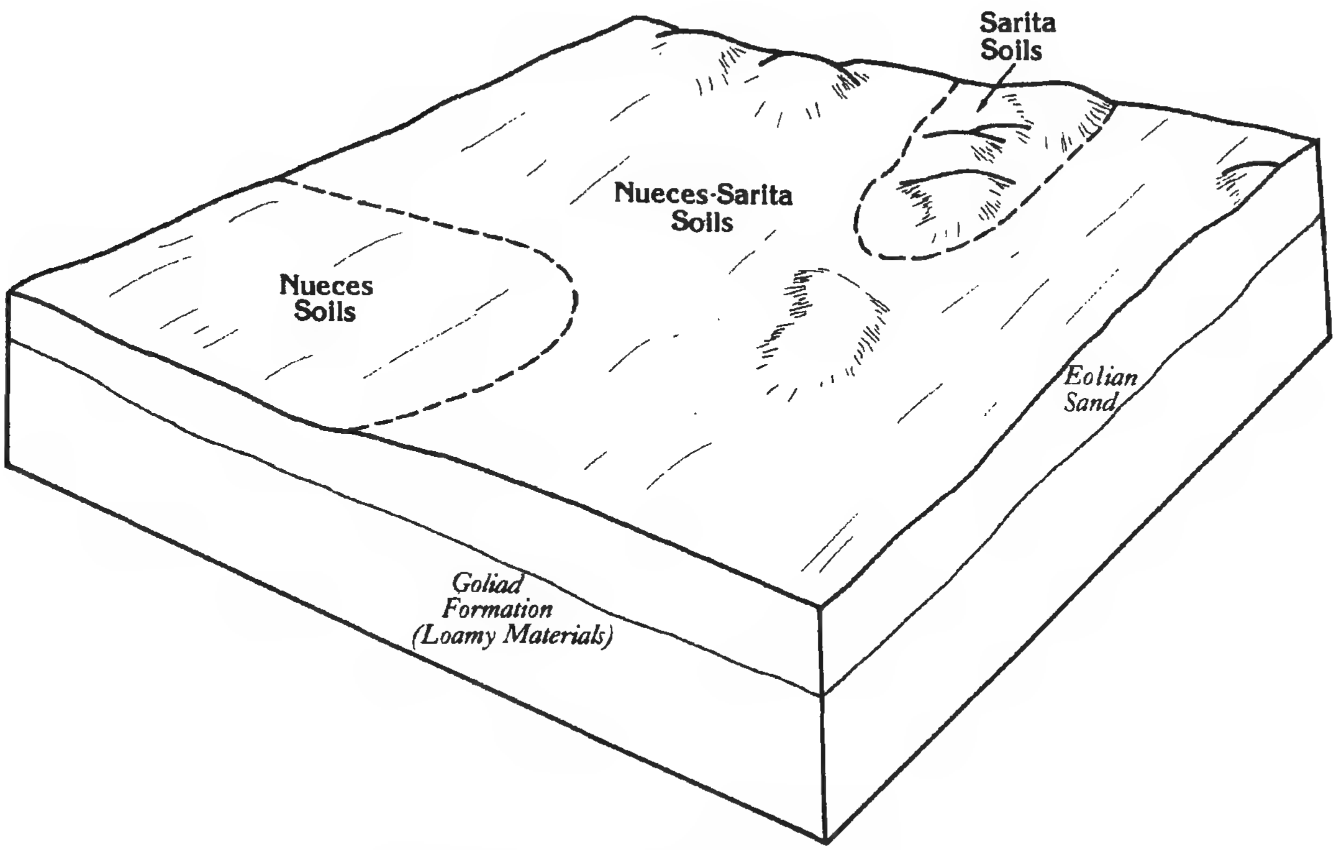


Figure 2.—Pattern of soils in the Nueces-Sarita map unit.

Comitas and Hebbronville soils are in positions similar to those of Nueces soils. Falfurrias soils are in slightly higher positions than Nueces and Sarita soils. Rio and Tiocano soils are in small, enclosed depressional areas.

Soils in this unit are used mostly as rangeland. A few areas are used as nonirrigated cropland and are sprinkler irrigated.

This unit has low potential for nonirrigated crops and medium potential for irrigated crops. Because of the thick sandy surface layer, careful selection of crops is necessary. Suitable crops are watermelons and peanuts.

Potential is low for nonirrigated pasture grasses and medium for irrigated pasture grasses. Improved bermudagrass and weeping lovegrass are suited to this unit.

This unit has a medium potential for rangeland. Climax vegetation is grasses, forbs, and woody plants.

Potential is low for urban and recreation uses. Urban and recreation uses are limited by the sandy surface layer.

8. Delfina-Hebbronville-Comitas

Deep, moderately slowly and moderately rapidly permeable soils that typically have a brown loamy fine sand or sandy loam surface layer

This map unit consists of nearly level to gently sloping soils on uplands. It occupies about 7 percent of the county. Delfina soils make up about 37 percent of the unit; Hebbronville soils 36 percent; Comitas soils 17 percent; and Brennan, Delmita, Nueces, Rio, Sarita, and Tiocano soils 10 percent.

Delfina and Hebbronville soils are nearly level to gently sloping. Comitas soils are gently sloping; they are in slightly higher positions.

Delfina soils are moderately well drained and moderately slowly permeable. Typically, these soils have a brown loamy fine sand surface layer about 16 inches thick. The subsoil, to a depth of 49 inches, is sandy clay loam mottled in shades of red and brown. The upper part is dark brown, and the lower part is brown. The underlying material to 72 inches is light brown sandy clay loam. These soils are noncalcareous to 49 inches.

Hebbronville soils are well drained and moderately rapidly permeable. Typically, these soils have a brown sandy loam surface layer about 17 inches thick. The subsoil, to a depth of 58 inches, is fine sandy loam. The upper part is brown, and the lower part is yellowish brown. The underlying layer to 65 inches is light yellowish brown fine sandy loam. These soils are noncalcareous to 39 inches.

Comitas soils are well drained and moderately rapidly permeable. Typically, these soils have a brown loamy fine sand surface layer about 28 inches thick. The underlying material to 80 inches is reddish yellow fine sandy loam. These soils are noncalcareous to 49 inches.

Brennan soils are in slightly lower positions than Delfina, Hebbronville, and Comitas soils. Delmita soils are in positions similar to those of Delfina soils. Nueces and Sarita soils are in slightly higher positions. Rio and Tiocano soils are in small, enclosed depressional areas.

Soils in this unit are used mostly as nonirrigated cropland and rangeland. A few areas are sprinkler irrigated or used for improved pasture.

This unit has low potential for nonirrigated crops and medium potential for irrigated crops. Suitable nonirrigated and irrigated crops are cotton, grain sorghum, and watermelons.

Potential is low for nonirrigated pasture grasses and medium for irrigated pasture grasses. Improved bermudagrass, buffelgrass, introduced bluestems, and other grasses are suited to this unit.

This unit has high potential for rangeland. Climax vegetation is grasses, forbs, and woody plants.

Potential is medium for urban and recreation uses. The main limitations are the shrinking and swelling of the Delfina soils and the sandy surface layer of the Comitas soils.

Dominantly nearly level, clayey and loamy soils; on terraces

Map unit 9 makes up about 9 percent of the county. The major soils are deep, moderately well drained or well drained, and very slowly permeable to moderately permeable. These moderately alkaline soils are on a nearly level ancient stream terrace. They are clayey or loamy throughout. The clayey soils when dry have deep, wide cracks on the surface. Water enters the soil rapidly through the cracks. Water enters slowly when the soil is wet and the cracks are sealed. The shrink-swell potential is very high in the clayey soils and moderate in the loamy soils.

These soils are used mainly as irrigated cropland. In a few areas they are used for improved pasture or for wildlife habitat.

9. Harlingen-Runn-Reynosa

Deep, very slowly, slowly, and moderately permeable soils that typically have a grayish brown clay, silty clay, or silty clay loam surface layer

This map unit consists of nearly level soils on terraces (fig. 3). It occupies about 9 percent of the county. Harlingen soils make up about 55 percent of the unit; Runn soils 27 percent; Reynosa soils 10 percent; and Benito, Cameron, Laredo, and Olmito soils 8 percent.

Harlingen soils are in broad, nearly level, and slightly depressional areas. Runn soils are in nearly level areas, and Reynosa soils are in slightly higher positions.

Harlingen soils are moderately well drained and very slowly permeable. Typically, these soils have a grayish brown clay surface layer about 18 inches thick. The underlying material to 72 inches is brown clay. These soils are calcareous throughout.

Runn soils are moderately well drained and slowly permeable. Typically, these soils have a grayish brown silty clay surface layer about 18 inches thick. The

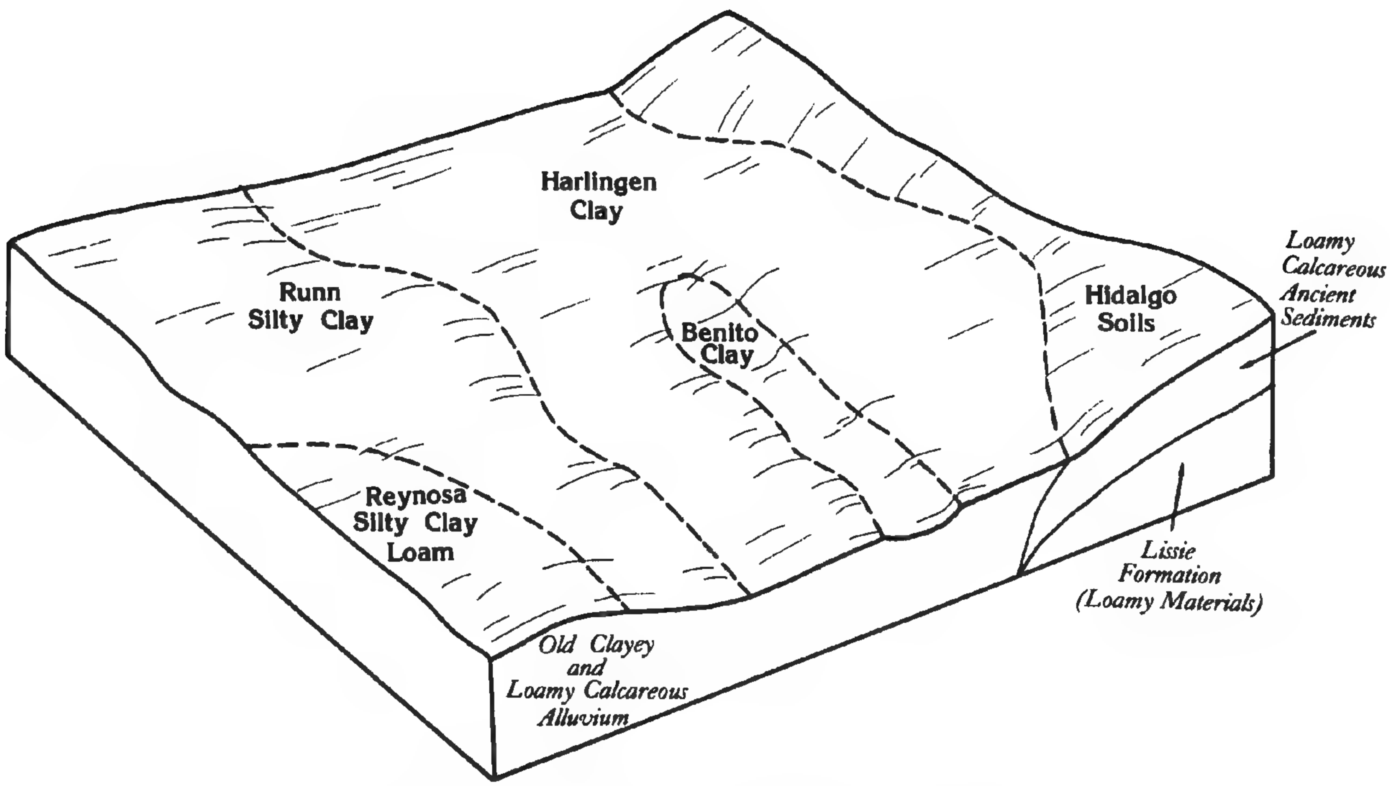


Figure 3.—Pattern of soils in the Harligen-Runn-Reynosa map unit.

subsoil, to a depth of 38 inches, is light brownish gray silty clay. The underlying material to 65 inches is moderately alkaline, pale brown silty clay in the upper part and silty clay loam in the lower part. These soils are calcareous throughout.

Reynosa soils are well drained and moderately permeable. Typically, these soils have a grayish brown silty clay loam surface layer about 15 inches thick. The subsoil, to a depth of 48 inches, is light brownish gray silty clay loam. The underlying material to 65 inches is pale brown silt loam. These soils are calcareous throughout.

Benito soils are slightly lower on the landscape than Harlingen soils. Cameron and Olmito soils are in positions similar to those of Runn soils. Laredo soils are in positions similar to those of Reynosa soils.

Soils in this unit are used mostly as irrigated cropland. A few areas of Benito, Harlingen, and Runn soils are used for improved pasture and wildlife habitat. Moderate to strong salinity affects about 15 to 25 percent of the acreage in this unit.

This unit has medium potential for nonirrigated crops and high potential for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, and cool and warm season vegetables. Potential for sugarcane is low on Harlingen soils, medium on Runn soils, and high on Reynosa soils. Reynosa and Laredo soils are the only soils in this unit suitable for citrus.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Coastal bermudagrass, African stargrass, and other grasses are suited to the soils.

This unit has high potential for rangeland, but it is not used for this purpose.

Potential is low for urban and recreation uses on the clayey soils and moderate on the loamy soils. The shrinking and swelling of the soils and the clayey surface layer are the main limitations.

Dominantly nearly level, loamy and clayey soils; on uplands

Maps units 10 and 11 make up about 6 percent of the county. The soils are deep, well drained or moderately well

drained and moderately permeable to very slowly permeable. These soils are on a nearly level upland plain. They are loamy or clayey. When dry the clayey soils have deep, wide cracks on the surface. Water enters the soil rapidly through the cracks, but when the soil is wet and the cracks are sealed, water enters slowly. The shrink-swell potential is very high in the clayey soils and moderate in the loamy soils.

Most of these soils are used as irrigated cropland. A few of these soils are used as nonirrigated cropland or for improved pasture.

10. Raymondville-Mercedes

Deep, slowly and very slowly permeable soils that typically have a gray clay loam or clay surface layer

This map unit consists of nearly level soils on uplands. It occupies about 4 percent of the county. Raymondville soils make up about 61 percent of the unit; Mercedes soils 30 percent; and Hidalgo, Racombes, Rio, and Willacy soils 9 percent.

Raymondville soils are in the level positions, and Mercedes soils are in the slightly lower positions.

Raymondville soils are moderately well drained and slowly permeable. Typically, these soils have a clay loam surface layer about 15 inches thick that is gray in the upper part and dark gray in the lower part. The subsoil, to 43 inches, is grayish brown clay loam in the upper part and clay in the lower part. The underlying material to 65 inches is clay. The upper part is light brownish gray, and the lower part is pale brown. These soils are calcareous throughout.

Mercedes soils are moderately well drained and very slowly permeable. Typically, these soils have a gray clay surface layer about 30 inches thick. The subsoil, to a depth of 57 inches, is light brownish gray clay. The underlying material to a depth of 65 inches is pale brown clay. These soils are calcareous throughout.

Hidalgo and Willacy soils are in the slightly higher positions. Racombes soils are in positions similar to those of Raymondville soils. Rio soils are in small, enclosed depressional areas.

Soils in this unit are used mostly as irrigated cropland. A few areas are used as nonirrigated cropland and for improved pasture. Moderate to strong salinity affects about 15 to 25 percent of the acreage in this unit.

This unit has medium potential for nonirrigated crops and high potential for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, and cool and warm season vegetables. Potential for sugarcane is medium on Raymondville soils and low on Mercedes soils. This unit is not suitable for citrus.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Coastal bermudagrass, African stargrass, introduced bluestems, and other grasses are suited to this unit.

This unit has medium potential for rangeland, but it is not used for this purpose.

The potential is low for urban and recreation uses. The shrinking and swelling of the soils and the clayey surface layer are the main limitations.

11. Raymondville-Hidalgo

Deep, slowly and moderately permeable soils that typically have a gray or dark grayish brown clay loam or sandy clay loam surface layer

This map unit consists of nearly level soils on uplands. It occupies about 2 percent of the county. Raymondville soils make up about 54 percent of the unit, Hidalgo soils 43 percent, and Mercedes and Racombes soils 3 percent.

Raymondville soils are in the level positions, and Hidalgo soils are in the slightly higher positions.

Raymondville soils are moderately well drained and slowly permeable. Typically, these soils have a clay loam surface layer about 15 inches thick that is gray in the upper part and dark gray in the lower part. The subsoil, to a depth of 43 inches, is grayish brown clay loam in the upper part and clay in the lower part. The underlying material to 65 inches is clay. The upper part is light brownish gray and the lower part pale brown. These soils are calcareous throughout.

Hidalgo soils are well drained and moderately permeable. Typically, these soils have a dark grayish brown, sandy clay loam surface layer about 17 inches thick. The subsoil, to a depth of 38 inches, is sandy clay loam. It is brown in the upper part and pale brown in the lower part. The underlying material to 80 inches is very pale brown clay loam. These soils are calcareous throughout.

Mercedes soils are slightly lower on the landscape than Raymondville soils. Racombes soils are in positions similar to those of Raymondville soils.

Soils in this unit are used mostly as irrigated cropland. A few areas are used as nonirrigated cropland and for improved pasture. A few areas of Hidalgo soils are used for citrus. Moderate to severe salinity affects about 10 to 15 percent of the acreage in this unit.

This unit has medium potential for nonirrigated crops and high potential for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, and cool and warm season vegetables. Potential for sugarcane is medium on Raymondville soils and high on Hidalgo soils. Citrus is suitable only on Hidalgo soils.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Coastal bermudagrass, African stargrass, introduced bluestems, and other grasses are suited to this unit.

This unit has medium potential for rangeland, but it is not used for this purpose.

Potential is low for urban uses and recreation. Shrinking and swelling with moisture changes in the soil and the clayey surface layer are the main limitations.

Dominantly nearly level, loamy and clayey soils; on bottom lands

Map unit 12 makes up about 3 percent of the county. The major soils are deep, well drained or moderately well drained, and moderately permeable or slowly permeable. These moderately alkaline soils are on the nearly level flood plain. They are loamy or clayey throughout. When dry the clayey soils have deep, wide cracks on the surface. Water enters the soil rapidly through the cracks, but when the soil is wet the water enters slowly. The shrink-swell potential is high in the clayey soils and low in the loamy soils.

These soils are used mainly as irrigated cropland. In a few areas they are used for improved pasture or for wildlife habitat. The soils are rarely flooded because of the Falcon and Amistad Dams on the Rio Grande; however, there is a hazard of flooding, especially when tropical storms bring high-intensity rainfall into the Rio Grande watershed of northern Mexico.

12. Rio Grande-Matamoros

Deep, moderately and slowly permeable soils that typically have a light brownish gray or grayish brown silt loam or silty clay surface layer

This map unit consists of nearly level soils on bottom lands. It occupies about 3 percent of the county (fig. 4). Rio Grande soils make up about 42 percent of the unit; Matamoros soils 24 percent; and Camargo, Grulla, and Zalla soils 34 percent.

Rio Grande soils are in the higher positions. Matamoros soils are in the nearly level lower positions.

Rio Grande soils are well drained and moderately permeable. Typically, these soils have a light brownish gray silt loam surface layer about 8 inches thick. The underlying material to a depth of 65 inches is brown silt loam, silty clay loam, or very fine sandy loam. Thin strata of contrasting textures occur throughout the soil. These soils are calcareous throughout.

Matamoros soils are moderately well drained and slowly permeable. Typically, these soils have a grayish brown silty clay surface layer about 8 inches thick. The underlying material to a depth of 65 inches is light brownish gray or grayish brown silty clay. Thin strata of contrasting textures occur throughout the soil. These soils are calcareous throughout.

Camargo soils are in positions similar to those of Rio Grande soils. Grulla soils are in old river channels or

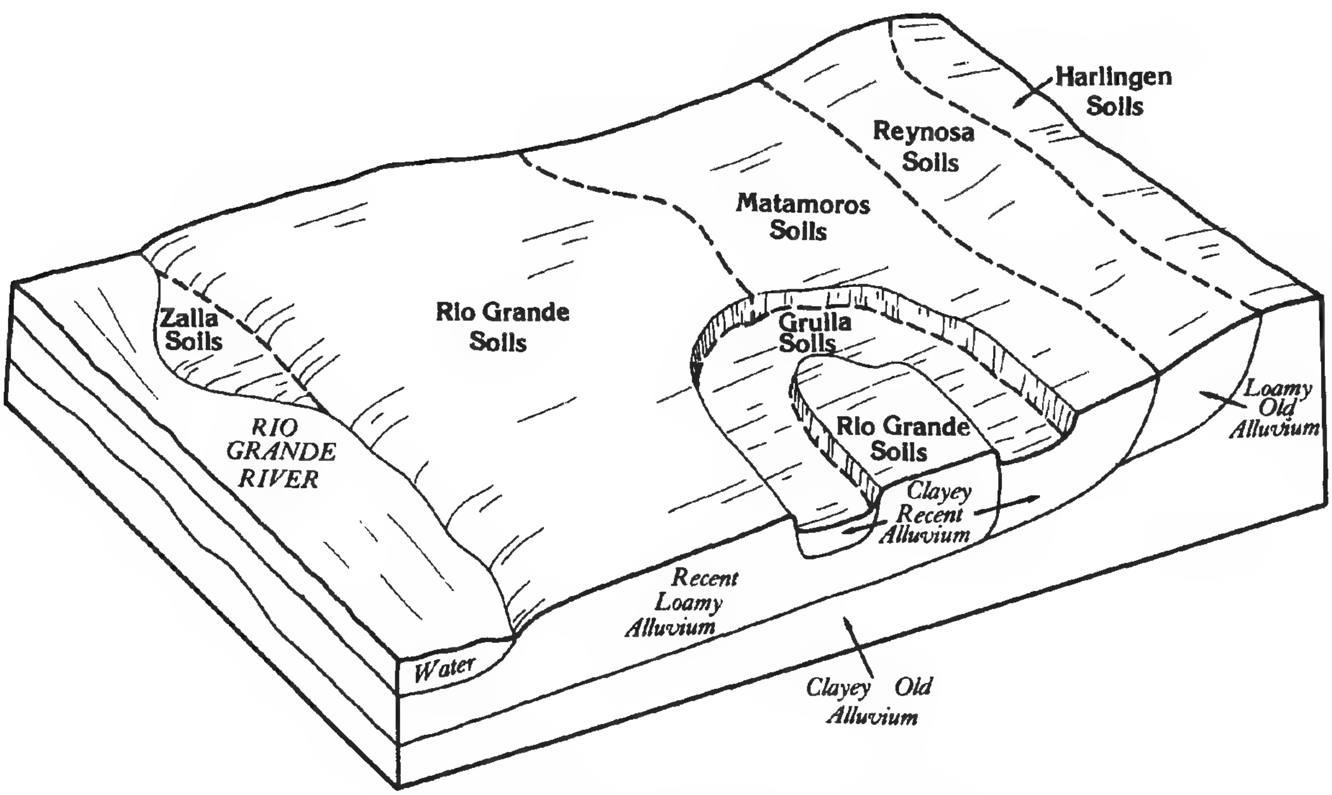


Figure 4.—Pattern of soils in the Rio Grande-Matamoros map unit.

oxbows. Zalla soils are normally within the inside curves of the river.

Soils in this unit are used mostly as irrigated cropland. A few areas of Zalla and Grulla soils are used for improved pasture and wildlife habitat.

This unit has medium potential for nonirrigated crops and high potential for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, and cool and warm season vegetables. Potential for sugarcane is high for the loamy soils and medium for the clayey soils. This unit is not suitable for citrus because of the hazard of flooding.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Coastal bermudagrass, African stargrass, and other grasses are suited to this unit.

This unit has high potential for rangeland, but it is not used for this purpose.

Potential is low for urban and recreation uses because of the hazard of flooding.

Dominantly pits and gently sloping to sloping, gravelly loamy soils; on uplands

Map unit 13 makes up about 1 percent of the county. These soils are shallow to very shallow, either well drained or excessively drained, and moderately permeable. The gravelly soils are on gently sloping to sloping upland ridges. They are underlain by indurated caliche.

These soils are used as a source of commercial caliche and gravel. Some of these soils are used as rangeland.

13. Pits-Jimenez-Quemado

Gravel pits and very shallow to shallow, moderately permeable soils that typically have a brown or dark brown very gravelly loam or very gravelly sandy loam surface layer

This unit consists of gently sloping to sloping soils on uplands. It occupies less than 1 percent of the county. Gravel pits make up about 51 percent of the unit; Jimenez soils 21 percent; Quemado soils 10 percent; and Cuevitas, McAllen, and Randado soils 18 percent.

Gravel pits are the excavated areas within areas of Jimenez and Quemado soils. Jimenez and Quemado soils are on gently sloping to sloping ridges.

Gravel pits are excessively drained and moderately permeable. Typically, these areas range in size from 5 to 350 acres and are 10 to 30 feet deep.

Jimenez soils are excessively drained and moderately permeable. Typically, these soils have a brown very gravelly loam surface layer about 8 inches thick. Below this layer there is indurated caliche that becomes less cemented with depth and is about 50 percent, by volume, embedded siliceous gravel. These soils are calcareous throughout.

Quemado soils are well drained and moderately permeable. Typically, these soils have a dark brown very gravelly sandy loam surface layer about 6 inches thick. The subsoil, to a depth of 12 inches, is brown very gravelly sandy clay loam. Below this layer there is indurated caliche that becomes less cemented with depth and is about 50 percent, by volume, embedded siliceous gravel. These soils are noncalcareous above the caliche.

Cuevitas, McAllen, and Randado soils are in nearly level lower positions. Ramadero soils are in slightly depressed drainageways.

This unit is used as a source of commercial gravel. It is also used as rangeland.

This unit is not suited to use as cropland. The potential for pasture and for rangeland is low.

The potential for urban and recreation uses is low because of the shallow depth to indurated caliche and the gravelly surface layer.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in Hidalgo County. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Hidalgo fine sandy loam, 0 to 1 percent slopes, is one of several phases in the Hidalgo series.

Some map units are made up of two or more major soils. These map units are called soil complexes.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Delmita-Randado complex, 0 to 1 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, caliche is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 5 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil descriptions of the detailed map units follow.

1—Arents, loamy. These deep, nearly level soils are on uplands. These soils are in areas that were formerly low places and have been filled by land leveling for irrigation. Areas are small and rounded and range from 5 to 25 acres. Slopes are mostly less than 0.5 percent but range from 0 to 1 percent.

Arents, loamy, consist of several soils that are mixed by land leveling and deposited in layers 24 to 60 inches thick in depressional areas. The deposits are mostly parts of Delfina, Hidalgo, Hargill, and Willacy soils. Racombes, Rio, and Tiocano soils are in the depressional areas and now underlie the Arents soils.

Typically, Arents, loamy, are neutral to moderately alkaline, very dark grayish brown, dark grayish brown, grayish brown, brown, dark brown, strong brown, reddish brown, or pale brown fine sandy loam or sandy clay loam.

These soils are moderately well drained, and surface runoff is slow. Permeability is moderately slow. The available water capacity is medium. A perched water table will develop for a few days after heavy irrigation. The root zone is deep. The hazards of water erosion and soil blowing are slight.

Included in mapping are small areas of Hidalgo and Raymondville soils. These soils make up less than 15 percent of this map unit.

Arents, loamy, are used as irrigated cropland. Maintaining or improving soil tilth and fertility, managing irrigation water, and providing adequate surface and subsurface drainage are necessary. Cropping systems that include high residue crops are needed to improve soil tilth and to provide organic matter. Surface drainage is useful in removing excess surface water. Subsurface tile drainage lowers the water table that is perched after irrigation.

These soils have medium potential for crops. Suitable crops are cotton and grain sorghum, although other crops such as sugarcane and some cool and warm season vegetables are grown.

Potential is medium for pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Improved bermudagrass, buffelgrass, introduced bluestems, and other grasses are suited to these soils.

These soils are not used as rangeland. Potential for wildlife habitat is low because these soils are continuously cropped or fallowed.

Potential is low for urban and recreation uses. Wetness, shrinking and swelling, and high corrosivity to uncoated steel are the main limitations.

These soils are in capability subclass IIw, irrigated. They are not assigned to a range site.

2—Benito clay. This deep, nearly level saline soil is in depressional areas of ancient stream terraces. Slopes are mainly less than 0.5 percent but range from 0 to 1 percent. Areas are small and irregular in shape or long and narrow and range from 10 to 75 acres.

Typically, the surface layer is gray clay about 56 inches thick with intersecting slickensides in the lower part. The next layer extending from 56 to 65 inches is light gray clay. Exchangeable sodium increases with depth and in some places exceeds 15 percent below a depth of 20 inches. The soil is calcareous throughout.

This soil is poorly drained. Surface runoff is ponded, and permeability is very slow. The available water capacity is low. This soil is occasionally flooded for long periods after heavy rainfall, usually less often than once in 2 years on the average. This soil is moderately to strongly saline. Water enters the soil rapidly through cracks when the soil is dry, but it enters very slowly when the soil is wet and the cracks are sealed. The rooting zone is deep but is not easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Harlingen and Runn soils. These soils make up less than 10 percent of this map unit.

This Benito soil is used for improved pasture; some areas are used as irrigated cropland. A few areas are idle.

This soil has low potential for nonirrigated and irrigated crops. Because of salinity careful selection of crops is necessary. The most suitable crop is cotton; some grain sorghum is grown. This soil is not suitable for citrus or sugarcane.

If this soil is used as cropland, maintaining or improving soil tilth, adapting cropping systems to the soil limitations, managing irrigation water, and providing adequate surface and subsurface drainage are necessary. Cropping systems that include high residue crops are needed to improve or maintain soil tilth. Crop residue should be left on the surface to reduce evaporation and surface crusting. Land leveling reduces runoff and permits a better distribution of irrigation water. Surface drainage is needed to remove excess water. Subsurface tile drainage is not practical because of the high content of clay in this soil.

This soil has low potential for nonirrigated and irrigated pasture grasses. However, proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain established grasses. Surface drainage is needed in some places. Because of salinity, establishing grass is difficult, especially from seed.

The potential is low for rangeland. In open grassland, dominant grasses in the potential plant community consist of gulf cordgrass, alkali sacaton, and switchgrass; woody plants include spiny aster and pricklypear; and forbs include Texas varilla and slim aster. Variations in salinity and soil moisture cause local variations in the plant community.

With continuous heavy grazing by livestock, gulf cordgrass, alkali sacaton, and switchgrass decrease in the plant community. These plants are replaced by the less desirable whorled dropseed, buffalograss, and knotroot bristlegrass. If heavy grazing continues for many years, mesquite, shoregrass, bushy sea-oxeye, glasswort, and pickleweed dominate the site.

Potential of this soil is low for wildlife habitat because little plant cover is provided. However, the potential is medium for habitat for wetland wildlife, including ducks, geese, herons, and muskrats.

Potential is low for urban and recreation uses. Shrinking and swelling with moisture changes in the soil, corrosivity of uncoated steel, wetness, very slow permeability, and the clay surface layer are the main limitations.

This Benito soil is in capability subclass VIs, nonirrigated and in subclass IVw, irrigated; it is in the Salty Prairie range site.

3—Brennan fine sandy loam, 0 to 1 percent slopes. This deep, nearly level soil is on convex uplands. Areas are mostly broad and irregular in shape and range from 25 to 250 acres.

Typically, the surface layer is dark brown fine sandy loam about 13 inches thick. The upper part of the subsoil, from 13 to 29 inches, is brown sandy clay loam. The lower part, from 29 to 47 inches, is pale brown sandy clay loam. The next layer extending from 47 to 65 inches is very pale brown sandy clay loam. The soil is noncalcareous to 29 inches.

This soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is medium. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thin surface layer because of cutting; in a few areas it has a thicker surface layer because of filling; and in a few areas all of the surface layer has been removed. The root zone is deep and is easily penetrated by plant roots. The water erosion hazard is slight, and the hazard of soil blowing is moderate.

Included with this soil in mapping are small areas of McAllen, Hidalgo, and Delmita soils. Also included are a few areas of a soil similar to this Brennan soil except that it has indurated caliche at a depth of 48 to 60 inches. The included soils make up less than 15 percent of this map unit.

This Brennan soil is used mostly as nonirrigated and irrigated cropland, as rangeland, and for citrus.

Potential is medium for nonirrigated crops and high for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum (fig. 5), sugarcane, and cool and warm season vegetables. This soil has high potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, and conserving soil moisture are necessary. Cropping systems that include high residue crops help to maintain or improve soil tilth, reduce evaporation, provide organic matter, and control soil blowing. Land leveling reduces runoff and permits a better distribution of irrigation water. Subsurface tile drainage lowers the high water table that can develop from irrigation. Stripcropping helps control soil blowing.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed. Improved bermudagrass, buffelgrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland. In open grassland, dominant grasses in the potential plant community consist of twoflower trichloris, tanglehead, and fourflower trichloris; woody plants include vine ephedra and kidneywood; and forbs include Engelmann-daisy and bushsunflower.

With continuous heavy grazing by livestock, twoflower trichloris, tanglehead, and fourflower trichloris decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, pink pappusgrass, and Hall panicum. If heavy grazing continues for many years, mesquite, blackbrush, condalias, pricklypear, and other woody plants form a dense canopy that has an understory of plants such as red grama, threeawn, and

Figure 5.—Irrigated grain sorghum and citrus on Brennan fine sandy loam, 0 to 1 percent slopes.

sandbur. Brush encroachment on this soil is a major range management problem.

This soil has medium potential for use as habitat for deer and javelina. Nesting areas are plentiful for quail, doves, and songbirds.

Potential is high for urban and recreation uses.

This Brennan soil is in capability subclass IIIc, nonirrigated and in class I, irrigated; it is in the Sandy Loam range site.

4—Brennan fine sandy loam, 1 to 3 percent slopes. This deep, gently sloping soil is on convex uplands. Areas are mostly broad and irregular in shape and range from 10 to more than 250 acres.

Typically, the surface layer is dark brown fine sandy loam about 12 inches thick. The upper part of the subsoil, from 12 to 28 inches, is brown sandy clay loam. The lower part, from 28 to 47 inches, is pale brown sandy clay loam. The layer extending from 47 to 65 inches is very pale brown sandy clay loam. The soil is noncalcareous to a depth of 28 inches.

This soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is medium. A few areas of this soil have been altered by land leveling for irrigation. In those areas the soil has a thin surface layer because of cutting. In a few areas, all of the surface layer has been removed. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are small areas of McAllen, Hidalgo, and Delmita soils. The included soils make up less than 15 percent of this map unit.

This Brennan soil is used mostly as nonirrigated and irrigated cropland, as rangeland, and for citrus.

Potential is medium for nonirrigated crops and high for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. This soil has high potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, conserving soil moisture, and controlling erosion are necessary. Cropping systems that include high residue crops help to maintain or improve soil tilth, reduce evaporation, provide organic matter, and control soil blowing. Land leveling reduces erosion and permits a better distribution of irrigation water. Bench leveling can reduce the depth of cuts made by land leveling. Subsurface tile drainage lowers the high water table that can develop in irrigated areas. Contour farming in nonirrigated areas helps reduce erosion. Stripcropping helps control soil blowing.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed. Improved bermudagrass, buffelgrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland. In open grassland, dominant grasses in the potential plant community consist of twoflower trichloris, tanglehead, and fourflower trichloris; woody plants include vine ephedra and kidneywood; and forbs include Engelmann-daisy and bushsunflower.

With continuous heavy grazing by livestock, twoflower trichloris, tanglehead, and fourflower trichloris decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, pink pappusgrass, and Hall panicum. If heavy grazing continues for many years, mesquite, blackbrush, condalias, pricklypear, and other woody plants form a dense canopy that has an understory of plants such as red grama, threeawn, and sandbur. Brush encroachment on this soil is a major range management problem.

This soil has medium potential for use as habitat for deer and javelina. However, nesting areas are plentiful for quail, doves, and songbirds.

Potential is high for urban and recreation uses.

This Brennan soil is in capability subclass IIIe, nonirrigated and in subclass IIe, irrigated; it is in the Sandy Loam range site.

5—Camargo silt loam. This deep, nearly level soil is on the active flood plain of the Rio Grande. Slopes range from 0 to 1 percent. Areas are small and irregular in shape and range from 10 to 30 acres.

Typically, the surface layer is light brownish gray silt loam about 8 inches thick. The next layer, from 8 to 20 inches, is grayish brown silty clay loam. The next layer, from 20 to 50 inches, is silt loam that is light brownish gray in the upper part and pale brown in the lower part. From 50 to 65 inches, it is pale brown very fine sandy loam. The soil is calcareous throughout.

This soil is well drained. Surface runoff is slow, and permeability is moderate. The available water capacity is high. This soil is rarely flooded; however, flooding is possible during tropical storms for brief periods. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thin surface layer because of cutting. In a few areas it has a thick surface layer because of filling. The rooting zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are small areas of Rio Grande and Camargo soils that have a clay loam surface layer. These soils are in long narrow streaks or rounded patches. Also included are a few small areas of Matamoros soils in depressional areas. The included soils make up less than 15 percent of this map unit.

This Camargo soil is used almost entirely as irrigated cropland. A few areas are used as pasture.

Potential is medium for nonirrigated crops and high for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. Potential is low for citrus because of the hazard of flooding.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, and

conserving soil moisture are necessary. Cropping systems that include high residue crops help to maintain or improve soil tilth, reduce evaporation, provide organic matter, and control soil blowing. Because of the strata of contrasting textures throughout the soil, a perched water table is common for a few days after heavy irrigation or rainfall. Land leveling reduces runoff and permits a better distribution of irrigation water. Also because of the contrasting textures, undesirable sandy material may be exposed in places by leveling. The high lime content of this soil can cause chlorosis of some plants. The lengths of irrigation runs are shorter for this Camargo soil than for soils with a silty clay loam surface layer.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Coastal bermudagrass, African stargrass, and similar grasses are suited to this soil.

Potential is high for rangeland, although no acreage is used as rangeland. Most areas of this soil have been cleared and are continuously cropped; however, a few areas remain undisturbed. In these areas, the potential is high for wildlife habitat including habitat for weasel and armadillo. Nesting areas are good for white-winged doves, chachalaca, songbirds, and many migratory birds.

Potential is low for urban and recreation uses because of the hazard of flooding.

This Camargo soil is in capability subclass IIIc, nonirrigated and in class I, irrigated; it is in the Loamy Bottomland range site.

6—Camargo silty clay loam. This deep, nearly level soil is on the active flood plain of the Rio Grande. Slopes are mainly less than 0.5 percent but range from 0 to 1 percent. Areas are small and irregular in shape and range from 10 to 25 acres.

Typically, the surface layer is grayish brown silty clay loam about 8 inches thick. The next layer, from 8 to 15 inches, is also grayish brown silty clay loam. The next layer, from 15 to 37 inches, is pale brown silt loam. The layer extending from 37 to 65 inches is grayish brown silty clay loam. Thin strata of contrasting textures occur throughout the soil. The soil is calcareous throughout.

This soil is well drained. Surface runoff is slow, and permeability is moderate. The available water capacity is high. This soil is rarely flooded; however, flooding is possible for brief periods during tropical storms. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thick surface layer because of filling. In a few areas it has a thin surface layer because of cutting. The rooting zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Rio Grande and Camargo soils that have a clay loam surface layer. Also included are a few small areas of Matamoros soils in depressions. The included soils make up less than 15 percent of this map unit.

This Camargo soil is used almost entirely as irrigated cropland. A few areas are used as pasture.

Potential is medium for nonirrigated crops and high for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. Potential is low for citrus because of the hazard of flooding.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, and conserving soil moisture are necessary. Cropping systems that include high residue crops help to maintain or improve soil tilth and provide organic matter. Because of the strata of contrasting textures throughout the soil, a perched water table is common for a few days after heavy irrigation or rainfall. Land leveling reduces runoff and permits a better distribution of irrigation water. Also because of the contrasting textures, undesirable material may be exposed in places by land leveling. The high lime content of this soil can cause chlorosis of some plants.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Coastal bermudagrass, African stargrass, and similar grasses are suited to this soil.

Potential is high for rangeland, although no acreage is used as such. Most of this soil has been cleared and is continuously cropped; however, a few areas remain undisturbed. Potential is high in these areas for wildlife habitat including habitat for coyote, weasel, and armadillo. Nesting areas are plentiful for white-winged doves, chachalaca, and many migratory birds.

Potential is low for urban and recreation uses because of the hazard of flooding.

This Camargo soil is in capability subclass IIIc, nonirrigated and in class I, irrigated; it is in the Loamy Bottomland range site.

7—Cameron silty clay. This deep, nearly level soil is on ancient stream terraces. Slopes are mainly less than 0.5 percent but range from 0 to 1 percent. Areas are small and irregular in shape and range from 10 to 45 acres.

Typically, the surface layer is dark grayish brown silty clay about 18 inches thick. The next layer, from 18 to 30 inches, is brown silty clay. The layer extending from 30 to 65 inches is pale brown silt loam. The soil is calcareous throughout.

This soil is moderately well drained. Surface runoff is slow, and permeability is moderately slow. The available water capacity is high. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thick surface layer because of filling, and in a few areas it has a thin surface layer because of cutting. The rooting zone is deep but is hard for plant roots to penetrate. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Laredo and Olmito soils. The included soils make up less than 10 percent of this map unit.

This Cameron soil is used mainly as irrigated cropland. A few areas are used as pastureland.

Potential is high for nonirrigated crops and for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, and cool and warm season vegetables. This soil has a medium potential for sugarcane. The suitability of citrus is questionable because of the high content of clay in the upper part of the soil.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, and providing surface drainage are necessary. Cropping systems that include high residue crops help to improve or maintain soil tilth. Land leveling increases the efficiency of irrigation and permits a better distribution of irrigation water. Surface drainage can be useful in removing excess water after a heavy rainfall. Subsurface tile drainage lowers the high water table that can develop under irrigation.

Potential is high for nonirrigated pasture grasses and high for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed. Coastal bermudagrass, African stargrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland, although no acreage is used as such. Most of this soil has been cleared and is continuously cultivated; however, a few areas remain undisturbed. The potential in these areas is medium for wildlife habitat including habitat for coyote, weasel, and armadillo. Nesting areas are good for white-winged doves, chachalaca, songbirds, and many migratory birds.

Potential is low for urban and recreation uses. The main limitations are shrinking and swelling of the soil and the clayey surface layer.

This Cameron soil is in capability subclass IIs, nonirrigated and irrigated; it is in the Clayey Bottomland range site.

8—Comitas loamy fine sand, 0 to 3 percent slopes. This deep, nearly level to gently sloping soil is on convex uplands. Areas are elongated and have the long axis parallel to the prevailing southeasterly winds. These areas range from 40 to 200 acres.

Typically, the surface layer is brown loamy fine sand about 28 inches thick. The layer from 28 to 80 inches is reddish yellow fine sandy loam. This soil is noncalcareous to 49 inches.

This soil is well drained. Surface runoff is very slow, and permeability is moderately rapid. The available water capacity is medium. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thin surface layer because of cutting. In a few areas all of the surface layer has been removed. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is severe.

Included with this soil in mapping are small areas of Brennan, Hebbronville, and Delmita soils and a few areas of Sarita soils. The included soils make up less than 25 percent of this map unit.

This Comitas soil is used mostly as rangeland and as nonirrigated cropland. A few areas of this soil are sprinkler irrigated.

Potential is low for nonirrigated crops and medium for irrigated crops. Suitable crops are cotton, grain sorghum, and watermelons. This soil has medium potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, conserving soil moisture, and controlling soil blowing are necessary. Cropping systems that include high residue crops help to maintain soil tilth, reduce evaporation, provide organic matter, and control soil blowing. A properly designed sprinker system helps to conserve water. Contour farming helps reduce soil losses from erosion. Stripcropping helps control soil blowing.

Potential is low for nonirrigated pasture grasses and medium for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Improved bermudagrass, buffelgrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is medium for rangeland. In rangeland, the potential plant community is open grassland. Typically, the dominant grass plants are little bluestem, crinkleawn, and tanglehead; woody plants include Texas colubrina and spiny hackberry; and forbs include orange zexmenia and bushsunflower.

With continuous heavy grazing by livestock, little bluestem, crinkleawn, and tanglehead decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, fall witchgrass, pink pappusgrass, and fringeleaf paspalum. If heavy grazing continues for many years, mesquite, spiny hackberry, pricklypear, and other woody plants form a moderately dense canopy that has an understory of red lovegrass, fringed signalgrass, and threeawn. Brush encroachment on this soil is a major range management problem.

Potential is medium for wildlife habitat including habitat for deer, javelina, doves, quail, and songbirds.

Potential is medium for urban and recreation uses. The main limitation to recreation uses is the sandy surface layer. Low strength is a limitation for local roads and streets.

This Comitas soil is in capability subclass IVe, nonirrigated and in subclass IIIe, irrigated; it is in the Loamy Sand range site.

9—Delfina loamy fine sand, 0 to 3 percent slopes. This deep, gently sloping soil is on convex uplands. Areas are broad and irregular in shape and range from 25 to 2,500 acres.

Typically, the surface layer is brown loamy fine sand about 16 inches thick. The upper part of the subsoil, from 16 to 25 inches, is dark brown sandy clay loam that has yellowish red and grayish brown mottles. The lower part, from 25 to 37 inches, is brown sandy clay loam that has yellowish red mottles. The next layer, from 37 to 49 inches, is brown sandy clay loam that has grayish brown mottles. The layer extending from 49 to 72 inches is light brown sandy clay loam. This soil is noncalcareous to 49 inches.

This soil is moderately well drained. Surface runoff is slow, and permeability is moderately slow. The available water capacity is medium. This soil is saturated above the subsoil after heavy rainfall for short periods. A few areas of this soil have been altered by land leveling for irrigation. In these areas, the soil has a thin surface layer because of cutting. In a few areas, all of the surface layer has been removed. The root zone is deep but is not easily penetrated by plant roots below the surface layer. The hazard of water erosion is moderate, and the hazard of soil blowing is severe.

Included with this soil in mapping are a few areas of Brennan, Comitas, Nueces, and Willacy soils and Delfina soils that have a fine sandy loam surface layer. These soils make up less than 25 percent of this map unit.

This Delfina soil is used mostly as nonirrigated cropland and rangeland. A few areas are irrigated.

Potential is low for nonirrigated crops and medium for irrigated crops. Suitable crops are cotton, grain sorghum, and watermelons. This soil has medium potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, conserving soil moisture, and controlling erosion are necessary. Cropping systems that include high residue crops help to maintain soil tilth, reduce evaporation, provide organic matter, and control soil blowing. Land leveling reduces erosion and runoff, and permits better distribution of irrigation water. Bench leveling reduces the depth of required land-leveling cuts. Subsurface tile drainage lowers the high water table that can develop from irrigation when the soil is bench leveled. Temporary field ditches are difficult to maintain. If the soil has not been leveled, a properly designed sprinkler system helps to conserve water. Stripcropping helps control soil blowing.

Potential is low for nonirrigated pasture grasses and medium for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Improved bermudagrass, buffelgrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is medium for rangeland. In open grassland, the dominant grasses in the potential plant community consist of little bluestem, plains bristlegrass, and tanglehead; woody plants include Texas colubrina and spiny hackberry; and forbs include orange zexmenia and bushsunflower.

With continuous heavy grazing by livestock, little bluestem, plains bristlegrass, and tanglehead decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, pink pappusgrass, fall witchgrass, and fringeleaf paspalum. If heavy grazing continues for many years, mesquite, spiny hackberry, pricklypear, and other woody plants form a moderately dense canopy that has an understory of red lovegrass, fringed signalgrass, and threeawn. Brush encroachment on this soil is a major range management problem.

The potential is high for wildlife habitat including habitat for deer, javelina, doves, quail, and songbirds.

Potential is medium for urban and recreation uses. The main limitations are the shrinking and swelling of the soil, the moderately slow permeability, and the sandy surface layer.

This Delfina soil is in capability subclass IVe, nonirrigated and in subclass IIIe, irrigated; it is in the Loamy Sand range site.

10—Delfina fine sandy loam, 0 to 1 percent slopes. This deep, nearly level soil is on convex uplands. Areas are small and irregular in shape and range from 15 to 75 acres.

Typically, the surface layer is fine sandy loam, about 13 inches thick, that is grayish brown in the upper part and brown in the lower part. The subsoil extends to a depth of 72 inches or more. From 13 to 20 inches, it is brown sandy clay loam that has reddish yellow and dark grayish brown mottles. From 20 to 28 inches, it is brown sandy clay loam that has brownish yellow mottles. From 28 to 38 inches, it is pale brown sandy clay loam that has brownish yellow mottles. From 34 to 39 inches, it is light brown sandy clay loam. The layer extending from 39 to 72 inches is pink sandy clay loam. This soil is noncalcareous to 39 inches.

This soil is moderately well drained. Surface runoff is medium, and permeability is moderately slow. The available water capacity is medium. After heavy rainfall this soil is saturated above the subsoil for short periods. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thin surface layer because of cutting. In a few areas it has a thick surface layer because of filling, and in some areas all of the surface layer has been removed. The root zone is deep but is not easily penetrated by plant roots below the surface layer. The hazard of water erosion is slight, and the hazard of soil blowing is moderate.

Included with this soil in mapping are a few areas of Hargill, Willacy, and Racombes soils. These soils make up less than 20 percent of this map unit.

This Delfina soil is used mainly as irrigated and nonirrigated cropland, as rangeland, and for citrus.

Potential is medium for nonirrigated crops and high for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. This soil has medium potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, conserving

soil moisture, and providing surface drainage are necessary. Cropping systems that include high residue crops help to maintain soil tilth, reduce evaporation, provide organic matter, and control soil blowing. Land leveling reduces runoff and permits better distribution of irrigation water. Surface drainage is useful in removing excess water after heavy rainfall. Subsurface tile drainage lowers the high water table that can develop from irrigation. Temporary field ditches are difficult to maintain. Stripcropping helps control soil blowing.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed. Improved bermudagrass, buffelgrass, introduced bluestems, and other grasses are suited to this soil.

Potential is high for rangeland. In open grassland, the dominant grasses in the potential plant community consist of twoflower trichloris, fourflower trichloris, and plains bristlegrass; woody plants include vine ephedra and kidneywood; and forbs include Engelmann-daisy and bushsunflower.

With continuous heavy grazing by livestock, twoflower trichloris, fourflower trichloris, and plains bristlegrass decrease in the plant community. These plants are replaced by hooded windmillgrass, pink pappusgrass, buffalograss, and fringeleaf paspalum. If heavy grazing continues for many years, mesquite, condalias, pricklypear, and other woody plants form a dense canopy that has an understory of red grama, Texas grama, threeawn, and sandbur. Brush encroachment on this soil is a major range management problem.

The potential is high for wildlife habitat including habitat for deer, javelina, and coyote. Nesting areas are plentiful for quail, doves, and songbirds.

Potential is medium for urban and recreation uses. The main limitations are permeability and the shrinking and swelling of the soil.

This Delfina soil is in capability subclass IIs, nonirrigated and in subclass IIw, irrigated; it is in the Tight Sandy Loam range site.

11—Delfina fine sandy loam, 1 to 3 percent slopes. This deep, gently sloping soil is on convex uplands. Areas are small and irregular in shape and range from 10 to 75 acres.

Typically, the surface layer is grayish brown fine sandy loam about 15 inches thick. The subsoil extends to a depth of 65 inches or more. From 15 to 23 inches, it is grayish brown sandy clay loam that has yellowish red and dark grayish brown mottles. From 23 to 34 inches, it is brown sandy clay loam that has reddish yellow mottles. From 34 to 45 inches, it is pale brown sandy clay loam that has brownish yellow mottles. The layer extending from 45 to 65 inches or more is very pale brown sandy clay loam. This soil is noncalcareous to 45 inches.

This soil is moderately well drained. Surface runoff is medium, and permeability is moderately slow. The available water capacity is medium. This soil is saturated above the subsoil for a short time after a heavy rainfall. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thin surface layer because of cutting. In in a few areas, all of the surface layer has been removed. The root zone is deep but is not easily penetrated by plant roots below the surface layer. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are a few areas of Hargill and Willacy soils. These soils make up less than 15 percent of this map unit.

This Delfina soil is used mostly as irrigated and nonirrigated cropland, as rangeland, and for citrus.

Potential is medium for nonirrigated crops and high for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. This soil has medium potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, conserving soil moisture, and controlling erosion are necessary. Cropping systems that include high residue crops help to maintain soil tilth, reduce evaporation, provide organic matter, and control soil blowing. Land leveling reduces erosion and runoff, and permits better distribution of irrigation water. Bench leveling reduces the depth of required land-leveling cuts. Subsurface tile drainage lowers the high water table that can develop from irrigation if the soil is bench leveled. Temporary field ditches are difficult to maintain. When this soil is not irrigated, contour farming helps reduce soil losses from erosion. Stripcropping helps control soil blowing.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Improved bermudagrass, buffelgrass, introduced bluestems, and other grasses are suited to this soil.

Potential is medium for rangeland. In rangeland, the potential plant community is open grassland. Typically, the dominant grass plants are twoflower trichloris, fourflower trichloris, and plains bristlegrass; woody plants include vine ephedra and kidneywood; and forbs include Engelmann-daisy and bushsunflower.

With continuous heavy grazing by livestock, twoflower trichloris, fourflower trichloris, and plains bristlegrass decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, pink pappusgrass, buffalograss, and fringeleaf paspalum. If heavy grazing continues for many years, mesquite, condalias, pricklypear, and other woody plants form a dense canopy that has an understory of red grama, Texas grama, threeawn, and sandbur. Brush encroachment on this soil is a major range management problem.

The potential is high for wildlife habitat including habitat for deer, javelina, and coyote. Nesting areas are plentiful for quail, doves, and songbirds.

Potential is medium for urban and recreation uses. The main limitations are permeability and the shrinking and swelling of the soil.

This Delfina soil is in capability subclass IIIe, nonirrigated and in subclass IIe, irrigated; it is in the Tight Sandy Loam range site.

12—Delmita loamy fine sand, 0 to 3 percent slopes. This moderately deep, gently sloping soil is on convex uplands. These areas are broad and irregular in shape and range from 20 to 950 acres.

Typically, Delmita loamy fine sand has a brown surface layer about 12 inches thick. The upper part of the subsoil, from 12 to 28 inches, is yellowish red sandy clay loam. The lower part, from 28 to 38 inches, is red sandy clay loam. Indurated caliche is below the subsoil. The soil is noncalcareous above the caliche.

This soil is well drained. Runoff is slow, and permeability is moderate. The available water capacity is low. The root zone is moderately deep. The hazard of water erosion is moderate, and the hazard of soil blowing is severe.

Included with this soil in mapping are small areas of Comitas, Hebbronville, and Randado soils and Delmita soils that have a fine sandy loam surface layer. These soils make up less than 30 percent or less of this map unit.

This Delmita soil is used mostly as nonirrigated cropland and rangeland. A few areas of this soil are sprinkler irrigated.

Potential is low for nonirrigated cropland and medium for irrigated cropland. Suitable crops are cotton, grain sorghum, and watermelons. This soil has low potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, conserving soil moisture, and controlling soil blowing are necessary. Cropping systems that include high residue crops help to maintain or improve soil tilth, reduce evaporation, provide organic matter, and control soil blowing. Stripcropping is effective in controlling soil blowing. Because of the shallow depth to indurated caliche, land leveling is not recommended.

Potential is low for nonirrigated pasture grasses and medium for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Suitable grasses are improved bermudagrass, blue panicgrass, and similar grasses.

Potential is medium for rangeland. In open grassland, the dominant grasses in the potential plant community consist of tanglehead, plains bristlegrass, and Arizona cottontop; woody plants include Texas colubrina and spiny hackberry; and forbs include orange zexmenia and bushsunflower.

With continuous heavy grazing by livestock, tanglehead, plains bristlegrass, and Arizona cottontop decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, fringeleaf paspalum, and slim tridens. If heavy grazing continues for many years, mesquite, spiny hackberry, pricklypear, and other woody plants form a moderately dense canopy that has an understory of red lovegrass, fringed signalgrass, threeawns and sandburs. Brush encroachment on this soil is a major range management problem.

Potential is medium for wildlife habitat including that for deer, javelina, quail, and songbirds.

Potential is medium for urban and recreation uses. The main limitation for urban uses is a cemented pan or indurated caliche below the surface. The hazard of soil blowing limits recreation uses.

This Delmita soil is in capability subclass IVe, nonirrigated and in subclass IIIe, irrigated; it is in the Loamy Sand range site.

13—Delmita-Randado complex, 0 to 1 percent slopes. This map unit consists of moderately deep to shallow, nearly level soils in areas that are so intricately mixed that separating them was not practical because of the scale used in mapping. These soils are on convex uplands. Areas are broad and irregular in shape and range from 20 to 950 acres.

Delmita fine sandy loam makes up about 50 percent of the unit, and Randado fine sandy loam makes up about 30 percent.

Typically, Delmita soil has a surface layer of reddish brown fine sandy loam about 13 inches thick. The subsoil, from 13 to 34 inches, is red sandy clay loam. Indurated caliche is below this layer. The soil is noncalcareous above the caliche.

The Delmita soil is well drained. Runoff is slow, and permeability is moderate. The available water capacity is low. When the soil is dry, the surface is hard and crusty. The root zone is moderately deep. The hazard of water erosion is slight, and the hazard of soil blowing is moderate.

Typically, Randado soil has a surface layer of reddish brown fine sandy loam about 9 inches thick. The subsoil, from 9 to 16 inches, is reddish brown sandy clay loam. Below this layer there is indurated caliche. The soil is noncalcareous above the caliche.

The Randado soil is well drained. Runoff is medium, and permeability is moderate. The available water capacity is very low. When the soil is dry, the surface is hard and crusty. The root zone is shallow. The hazard of water erosion is slight, and the hazard of soil blowing is moderate.

Included in mapping are small areas of Cuevitas soils and areas of rock outcrop. These areas are in slightly higher positions. A few small areas of soils that have slopes of 1 to 3 percent are also included. The included soils make up 20 percent or less of this map unit.

These Delmita and Randado soils are used mostly as nonirrigated cropland and rangeland. A few areas are sprinkler irrigated.

These soils have low potential for nonirrigated crops and medium potential for irrigated crops. Suitable

nonirrigated crops are cotton, grain sorghum, and watermelons. Suitable irrigated crops are cotton, grain sorghum, and cool and warm season vegetables. This unit has low potential for sugarcane and citrus.

If these soils are used as cropland, maintaining or improving soil tilth, conserving soil moisture, and controlling soil blowing are necessary. Cropping systems that include high residue crops help to maintain or improve soil tilth, reduce evaporation, reduce surface crusting, provide organic matter, and control soil blowing. Land leveling is not recommended because of the shallow depth to indurated caliche. Stripcropping helps control soil blowing.

These soils have low potential for nonirrigated pasture grasses and medium potential for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Suitable grasses are improved bermudagrass, blue panicgrass, and similar grasses.

Potential of these soils is medium for rangeland. If the Delmita soil is used as rangeland, the open grassland has a potential plant community consisting of grasses including Arizona cottontop, tanglehead, and plains bristlegrass; woody plants including lime pricklyash and guayacon; and forbs including bushsunflower and partridgepea.

With continuous heavy grazing by livestock, Arizona cottontop, tanglehead, and plains bristlegrass decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, slim tridens, fall witchgrass, and sand dropseed. If heavy grazing continues for many years, mesquite, condalias, pricklypear, and other woody plants form a dense canopy that has an understory of red lovegrass, threeawn, fringed signalgrass, and leatherstem. This becomes a major range management brush problem.

If the Randado soil is used as rangeland, the potential plant community is open grassland. Typically, the dominant grass plants are tanglehead, plains bristlegrass, silver bluestem, and Arizona cottontop; woody plants include guajillo and kidneywood; and forbs include bushsunflower and orange zexmenia.

Potential is medium for wildlife habitat including that for deer, javelina, quail, and songbirds.

Potential is medium for urban and recreation uses. The main limitation for urban uses is a cemented pan or indurated caliche below the surface.

These Delmita and Randado soils are in capability subclass IIIc, nonirrigated and in subclass IIs, irrigated. The Delmita soil is in the Red Sandy Loam range site, and the Randado soil is in the Shallow Sandy Loam range site.

14—Falfurrias fine sand, 0 to 5 percent slopes. This deep, nearly level to gently sloping soil is on convex uplands. Areas are small and elongated; the long axis is parallel to the prevailing southeasterly winds. Areas range from 30 to 100 acres.

Typically, the surface layer is light brown fine sand about 25 inches thick. The layer extending from a depth of 25 to 80 inches is pink fine sand. The soil is slightly acid in the upper part and neutral in the lower part.

This soil is somewhat excessively drained. Surface runoff is very slow, and permeability is rapid. The available water capacity is very low. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is severe.

Included with this soil in mapping are small areas of Sarita and Comitas soils. These soils make up less than 25 percent of this map unit.

This Falfurrias soil is used only as rangeland. It is too droughty for use as cropland.

Potential is low for pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain established plants. Improved bermudagrass and weeping lovegrass are suited to this soil. Loose seedbeds and the blowing sand make establishing grass difficult.

Potential is low for rangeland. In open grassland that has a few motts of mesquite trees, the dominant grasses consist of seacoast bluestem, indiangrass, and crinkleawn; woody plants include mesquite and pricklypear; and forbs include bundleflower and sensitivebrier.

With continuous heavy grazing by livestock, seacoast bluestem, indiangrass, and crinkleawn decrease in the plant community. These plants are replaced by the less desirable fringeleaf paspalum, gulfdune paspalum, and balsamscale. If heavy grazing continues for many years, red lovegrass, fringed signalgrass, threeawn, and sandburs will dominate the site. Woody plants increase only slightly.

Potential is low for wildlife habitat including habitat for deer, javelina, doves, and quail because effective plant cover is not available.

Potential is low for urban and recreation uses. The main limitation is the sandy surface layer.

This Falfurrias soil is in capability subclass VIIe, nonirrigated; it is in the Sandy Hill range site.

15—Grulla clay. This deep, nearly level soil is in partly filled resacas or oxbows on the active flood plain of the Rio Grande. Slopes are mainly less than 0.5 percent but range from 0 to 1 percent. Areas are long and narrow in shape and rarely exceed 50 acres. The soils are 1 to 5 feet below the surrounding landscape and have no natural drainage outlet.

Typically, the surface layer is grayish brown clay about 7 inches thick. The next layer, to a depth of 25 inches, is light brownish gray clay. The next layer, to 47 inches, is grayish brown clay. The next layer, to 59 inches, is an old buried surface layer that is gray clay. The layer extending from 59 to 68 inches is grayish brown clay. The soil is calcareous throughout.

This soil is somewhat poorly drained. Surface runoff is ponded. Unless artifically drained, this soil is frequently

flooded for long periods after heavy rainfall. Permeability is very slow. The available water capacity is medium. The root zone is deep but is not easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Matamoros and Rio Grande soils along the edges and upper ends of the oxbows. Also included are a few areas of a soil that is similar to this Grulla soil except that its surface layer is clay loam or silty clay. The included soils make up less than 10 percent of this map unit.

This Grulla soil is used as irrigated cropland, but loss of crops because of frequent ponding is a risk.

This soil has low potential for crops. Main crops are cotton, grain sorghum, and some cool season vegetables, but loss of crops by frequent flooding is a risk. This soil is not suitable for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, and providing adequate surface drainage are necessary. Cropping systems that include high residue crops help to improve or maintain soil tilth. Surface drainage is needed to remove possible ponded water. Subsurface tile drainage is not practical because of the high clay content of this soil.

This soil has medium potential for pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Common bermudagrass, Coastal bermudagrass, and similar grasses are suited to this soil. If pasture is grazed when the surface is wet, this soil puddles.

Potential is high for rangeland, although no acreage is used as such. The potential is medium for wildlife habitat including habitat for doves, quail, and furbearing animals; however, the potential is high for habitat for wetland wildlife including ducks, geese, and herons.

Potential is low for urban and recreation uses. Ponding, the shrinking and swelling of the soil, and the clay surface layer are the main limitations.

This Grulla soil is in capability subclass IVw, nonirrigated and irrigated; it is in the Clayey Bottomland range site.

16—Hargill fine sandy loam, 0 to 1 percent slopes. This deep, nearly level soil is on convex uplands. Areas are small and irregular in shape and range from 25 to 100 acres.

Typically, the surface layer is brown fine sandy loam about 18 inches thick. The upper part of the subsoil, from 18 to 47 inches, is reddish brown sandy clay loam. The lower part, from 47 to 63 inches, is yellowish red sandy clay loam. The layer extending from 63 to 80 inches is reddish yellow sandy clay loam. The soil is noncalcareous to 63 inches.

This soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is medium. A few areas of this soil have been altered by land leveling for irrigation. The altered areas have a thin surface layer because of cutting, a few areas have a thicker surface layer because of filling, and in a few areas all of the surface layer has been removed. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is slight, and the hazard of soil blowing is moderate..

Included with this soil in mapping are small areas of Willacy, Delfina, Hidalgo, and Racombes soils. Also included are a few areas of a soil that is similar to this Hargill soil except that the surface layer is loamy fine sand. The included soils make up less than 25 percent of this map unit.

This soil is used mostly as irrigated and nonirrigated cropland and for citrus.

Potential is medium for nonirrigated crops and high for irrigated crops. Nonirrigated crops are cotton and grain sorghum. Irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. This soil has high potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water and conserving soil moisture are necessary. Cropping systems that include high residue crops help to maintain soil tilth, reduce evaporation, provide organic matter, and control soil blowing. Land leveling reduces erosion and runoff and permits better distribution of irrigation water. Subsurface tile drainage lowers the high water table that can develop from irrigation. Temporary field ditches are difficult to maintain. Stripcropping helps control soil blowing (fig. 6).

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Improved bermudagrass, buffelgrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland. In open grassland, the dominant grasses in the potential plant community are tanglehead, fourflower trichloris, and plains bristlegrass; woody plants include desert yaupon and vine ephedra; and forbs include Engelmann-daisy and bushsunflower.

With continuous heavy grazing by livestock, tanglehead, fourflower trichloris, and plains bristlegrass decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, pink pappusgrass, slim tridens, and fall witchgrass. If heavy grazing continues for many years, mesquite, blackbrush, condalias, pricklypear, and other woody plants form a dense canopy that has an understory of red lovegrass, red grama, threeawns, and sandburs. Brush encroachment on this soil is a major range management problem.

The potential is high for use of the soil as habitat for deer, javelina, and coyote. Nesting areas are plentiful for doves, quail, and songbirds.

Potential is medium for urban uses and high for recreation uses. The main limitation is the shrinking and swelling of the soil with changes in the moisture content.

Figure 6.—Watermelons in young citrus orchard on Hargill fine sandy loam, 0 to 1 percent slopes. Triticale is planted to help control soil blowing.

This soil is in capability subclass IIc, nonirrigated and in class I, irrigated; it is in the Sandy Loam range site.

17—Hargill fine sandy loam, 1 to 3 percent slopes. This deep, gently sloping soil is on convex uplands. Areas are small and irregular in shape and range from 10 to 100 acres.

Typically, the surface layer is dark brown fine sandy loam about 16 inches thick. The upper part of the subsoil, to 24 inches, is brown sandy clay loam. The lower part, to 44 inches, is reddish brown sandy clay loam. The next layer, to 60 inches, is light brown sandy clay loam. The layer extending from 60 to 72 inches is reddish yellow sandy clay loam. The soil is noncalcareous to 44 inches.

This soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is medium. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thin surface layer because of cutting. In a few areas it has a thick surface layer because of filling, and in some areas all of the surface layer has been removed. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are small areas of Willacy, Delfina, and Hidalgo soils. Also included are a few areas of a soil that is similar to this Hargill soil except that its surface layer is loamy fine sand. The included soils make up less than 20 percent of this map unit.

This Hargill soil is used mostly as irrigated and nonirrigated cropland and for citrus.

Potential is medium for nonirrigated crops and high for irrigated crops. Nonirrigated crops are cotton and grain sorghum. Irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. This soil has high potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, conserving soil moisture, and controlling erosion are necessary. Cropping systems that include high residue crops help maintain soil tilth, reduce evaporation, provide organic matter, and control soil blowing. Land leveling reduces erosion and runoff, and it permits better distribution of irrigation water. Bench leveling reduces the depth of required cuts. Subsurface tile drainage lowers the high water table that can develop from irrigation if the soil is bench leveled. Temporary field ditches are difficult to maintain. When the soil is not irrigated, contour farming helps reduce soil losses from erosion. Stripcropping helps control soil blowing.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Improved bermudagrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland. In open grassland, the dominant grasses in the potential plant community consist of tanglehead, fourflower trichloris, and plains bristlegrass; woody plants include desert yaupon and vine ephedra; and forbs include Engelmann-daisy and bushsunflower.

With continuous heavy grazing by livestock, tanglehead, fourflower trichloris, and plains bristlegrass decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, pink pappusgrass, slim tridens, and fall witchgrass. If heavy grazing continues for many years, mesquite, blackbrush, condalias, pricklypear, and other woody plants form a dense canopy that has an understory of red lovegrass, red grama, threeawn, and sandburs. Brush encroachment on this soil is a major range management problem.

Potential is high for wildlife habitat including habitat for deer, javelina, and coyote. Nesting areas are plentiful for doves, quail, and songbirds.

Potential is medium for urban use and high for recreation use. The main limitation is shrinking and swelling of the soil.

This soil is in capability subclass IIe, nonirrigated and irrigated; it is in the Sandy Loam range site.

18—Hargill fine sandy loam, 3 to 5 percent slopes. This deep, gently sloping soil is on convex uplands. Areas are small and irregular in shape and range from 15 to 100 acres.

Typically, the surface layer is dark brown fine sandy loam about 15 inches thick. The upper part of the subsoil, to a depth of 30 inches, is reddish brown sandy clay loam. The lower part, from 30 to 42 inches, is light brown sandy clay loam. The next layer, from 42 to 60 inches, is pink sandy clay loam. The layer extending from 60 to 72 inches is reddish yellow sandy clay loam. The soil is noncalcareous to a depth of 42 inches.

This soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is medium. A few areas of this soil have been altered by land leveling for irrigation. The altered areas have a thin surface layer because of cutting, and in a few areas all of the surface layer has been removed. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is severe, and the hazard of soil blowing is moderate.

Included with this soil in mapping are small areas of Willacy, Hidalgo, and Delfina soils. Also included are a few areas of a soil that is similar to this Hargill soil except that its surface layer is loamy fine sand. The included soils make up less than 15 percent of this map unit.

This Hargill soil is used mostly as irrigated and nonirrigated cropland and for citrus.

Potential is low for nonirrigated crops and medium for irrigated crops. Nonirrigated crops are cotton and grain sorghum. Irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. If bench leveled, this soil has medium potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, conserving soil moisture, and controlling erosion are necessary. Cropping systems that include high residue crops help to maintain soil tilth, reduce evaporation, provide organic matter, and control soil blowing. Land leveling reduces erosion and runoff and permits a better distribution of irrigation water. Bench leveling reduces the depth of required land-leveling cuts. Subsurface tile drainage lowers the high water table that can develop from irrigation if the soil is bench leveled. If the soil has not been leveled, a properly designed sprinkler system helps to conserve water. When this soil is not irrigated, contour farming helps reduce soil losses from erosion. Stripcropping helps control soil blowing.

Potential is low for nonirrigated pasture grasses and medium for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Improved bermudagrass, buffelgrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland. In open grassland, the dominant grasses in the potential plant community consist of tanglehead, fourflower trichloris, and plains bristlegrass; woody plants include desert yaupon and vine ephedra; and forbs include Engelmann-daisy and bushsunflower.

With continuous heavy grazing by livestock, tanglehead, fourflower trichloris, and plains bristlegrass decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, pink pappusgrass, slim tridens, and fall witchgrass. If heavy grazing continues for many years, mesquite, blackbrush, condalias, pricklypear, and other woody plants form a dense canopy that has an understory of red lovegrass, red grama, threeawn, and sandburs. Brush encroachment on this soil is a major range management problem.

Potential is high for wildlife habitat including that for deer, javelina, and coyote. Nesting areas are plentiful for doves, quail, and songbirds.

Potential is medium for urban and recreation uses. The main limitations are slope and the shrinking and swelling of the soil.

This Hargill soil is in capability subclass IIIe, nonirrigated and irrigated; it is in the Sandy Loam range site.

19—Harlingen clay. This deep, nearly level soil is on broad areas of ancient stream terraces. Slopes are mainly less than 0.5 percent but range from 0 to 1 percent. These areas are broad and irregular in shape and range from 25 to more than 900 acres.

Typically, the surface layer is grayish brown clay about 18 inches thick. The next layer from 18 to 72 inches is brown clay that has many intersecting slickensides. The soil is calcareous throughout.

This soil is moderately well drained. Surface runoff is very slow. Permeability is very slow. The available water capacity is low. When this soil is dry, water enters it rapidly through cracks, but when this soil is wet and cracks are sealed, water enters very slowly. The root

zone is deep but is not easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Runn, Reynosa, and saline Harlingen soils. These soils make up less than 15 percent of this map unit.

This Harlingen soil is used almost entirely as irrigated cropland.

Potential is medium for nonirrigated crops and high for irrigated crops. Nonirrigated crops are cotton and grain sorghum. Irrigated crops are cotton, grain sorghum, and cool and warm season vegetables. This soil has low potential for sugarcane. This soil is not suitable for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, and providing surface drainage are necessary. Cropping systems that include high residue crops help to improve or maintain soil tilth. Land leveling increases the efficiency of irrigation and permits a better distribution of irrigation water. Surface drainage helps remove excess water after a heavy rainfall. Subsurface tile drainage is not practical because of the high clay content of this soil.

Potential is high for nonirrigated and irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Coastal bermudagrass, African stargrass, and introduced bluestems are suited to this soil.

Potential is high for rangeland, although no acreage is used as such. Most of this soil has been cleared and is continuously cropped; however, a few areas remain undisturbed as wildlife refuges. Potential in these areas is medium for habitat for coyote, weasel, armadillo, white-winged doves, chachalaca, and many migratory birds.

Potential is low for urban and recreation uses. Shrinking and swelling of the soil, corrosivity to uncoated steel, very slow permeability, and the clayey surface layer are the main limitations.

This Harlingen soil is in capability subclass IIIs, nonirrigated and irrigated; it is in the Clayey Bottomland range site.

20—Harlingen clay, saline. This deep, nearly level saline soil is on broad areas of ancient stream terraces. Slopes are mainly less than 0.5 percent but range from 0 to 1 percent. Areas are broad and irregular in shape and range from 10 to 500 acres.

Typically, the surface layer is saline, grayish brown clay about 16 inches thick. The next layer from 16 to 65 inches is saline, brown clay that has many intersecting slickensides. The soil is calcareous throughout.

This soil is moderately well drained. Surface runoff is very slow. Permeability is very slow, and the available water capacity is very low. This soil is moderately saline to strongly saline as a result of overirrigation and evaporation of slightly saline water. When this soil is dry, water enters it rapidly through cracks, but when the soil is wet and the cracks are sealed, water enters very slowly. The rooting zone is deep but is hard for plant roots to penetrate. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of saline Runn soils. Also included are a few areas of nonsaline Harlingen and Runn soils. The included soils make up less than 15 percent of this map unit.

This Harlingen soil is used mostly as irrigated cropland and pasture. A few areas are idle.

This soil has low potential for nonirrigated and irrigated crops. Because of salinity, careful selection of crops is necessary. Suitable crops are cotton and grain sorghum. This soil is not suitable for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, providing surface drainage, and adapting cropping systems to the soil are necessary. Cropping systems that include high residue crops help to improve or maintain soil tilth and reduce evaporation. Mulches, such as cotton burs, help reduce evaporation that brings harmful salts to the surface. Land leveling increases the efficiency of irrigation and permits a better distribution of irrigation water. Surface drainage helps remove excess water after a heavy rainfall. Subsurface tile drainage is not practical to leach out harmful salts because of the high clay content of this soil.

Potential is low for nonirrigated pasture grasses and medium for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Coastal bermudagrass, African stargrass, and introduced bluestems are suited to this soil. Establishing grass is difficult, especially from seed. If pasture is grazed when the surface is wet, this soil puddles. Surface drainage is useful in removing excess water after a heavy rainfall.

Potential is low for rangeland. This soil is not used as rangeland.

Potential is low for habitat for doves, quail, and furbearing animals. Potential is low for wetland wildlife habitat.

Potential is low for urban and recreation uses. The main limitations are shrinking and swelling of the soil, corrosivity to uncoated steel, very slow permeability, and the clayey surface layer.

This Harlingen soil is in capability subclass IVs, nonirrigated and irrigated. This soil is not assigned to a range site.

21—Harlingen-Urban land complex. This map unit consists of nearly level Harlingen soil and Urban land in areas so intricately mixed that separating them at the scale used in mapping was not practical. Areas are small and irregular in shape and range from 10 to 100 acres. Boundaries commonly coincide with the outer limits of subdivisions, builtup areas, and cities. Slopes are mainly less than 0.5 percent but range from 0 to 1 percent.

Harlingen soil makes up 35 to 80 percent of this map unit, Urban land 15 to 55 percent, and other soils 5 to 10 percent.

Typically, the Harlingen soil surface layer is grayish brown clay about 18 inches thick. The next layer, from 18 to 37 inches, is grayish brown clay that has many intersecting slickensides. The layer extending from 37 to 65 inches is brown clay. The soil is calcareous throughout.

Urban land consists of areas that are covered by buildings and other urban structures. Typical structures are single or multiple-unit dwellings, garages, sidewalks, patios, driveways, streets, schools, churches, shopping centers on less than 40 acres, office buildings, paved parking lots, and industrial sites. Some areas of the Harlingen soil have been altered by cutting, grading, and filling over the surface layer with 6 to 24 inches of clayey or loamy material.

Included in mapping are small areas of Runn and Reynosa soils.

Although the Harlingen soil and Urban land are used for urban structures, their potential for this use is low. The main limitations are high shrink-swell potential, high corrosivity for uncoated steel, and very slow permeability. Shrinking and swelling can cause streets, driveways, sidewalks, patios, ceilings, and buildings to crack and fences to shift. The soil is not suitable for septic tank filter fields. Potential is medium for landscaping and gardening on the soil because of the high clay content and the very slow permeability.

This map unit was not assigned to a capability subclass or range site.

22—Hebbronville sandy loam, 0 to 1 percent slopes. This deep, nearly level soil is on convex uplands. Areas are small and irregular in shape and range from 25 to 150 acres.

Typically, the surface layer is brown sandy loam about 17 inches thick. The subsoil, to a depth of 39 inches, is brown fine sandy loam. The next layer, to 58 inches, is yellowish brown fine sandy loam. The layer extending from 58 to 65 inches is light yellowish brown fine sandy loam. The soil is noncalcareous to 39 inches.

This soil is well drained. Surface runoff is slow, and permeability is moderately rapid. The available water capacity is medium. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thin surface layer because of cutting, and in a few areas all of the surface layer has been removed. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is slight, and the hazard of soil blowing is moderate.

Included with this soil in mapping are small areas of Brennan, Comitas, Delmita, and McAllen soils. These soils make up less than 20 percent of this map unit.

This Hebbronville soil is used mostly as rangeland and nonirrigated cropland. A few areas are irrigated.

Potential is medium for nonirrigated crops and high for irrigated crops. Nonirrigated crops are cotton, grain sorghum, and watermelons. Irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. This soil has high potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, conserving soil moisture, and controlling soil blowing are necessary. Cropping systems that include high residue crops help to maintain soil tilth, reduce evaporation, provide organic matter, and control soil blowing. Land leveling reduces erosion and runoff and permits a better distribution of irrigation water. Subsurface tile drainage lowers the high water table that can develop from irrigation. Temporary field ditches are difficult to maintain. Stripcropping helps control soil blowing.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Improved bermudagrass, buffelgrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland. In open grassland, the dominant grasses in the potential plant community consist of fourflower trichloris, twoflower trichloris, and tanglehead; woody plants include desert yaupon and vine ephedra; and forbs include Engelmann-daisy and bushsunflower.

With continuous heavy grazing by livestock, fourflower trichloris, twoflower trichloris, and tanglehead decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, pink pappusgrass, whiplash pappusgrass, and slim tridens. If heavy grazing continues for many years, mesquite, condalias, pricklypear, and other woody plants form a dense canopy that has an understory of red lovegrass, threeawn, and sandburs. Brush encroachment on this soil is a major range management problem.

Potential is high for habitat for deer and javelina. Nesting areas are plentiful for quail, doves, and songbirds.

Potential is high for urban uses and medium for recreation uses. The main limitation for recreation uses is the sandy surface layer.

This Hebbronville soil is in capability subclass IIIc, nonirrigated and in class I, irrigated; it is in the Sandy Loam range site.

23—Hebbronville sandy loam, 1 to 3 percent slopes. This deep, gently sloping soil is on convex uplands. Areas are small and irregular in shape and range from 15 to 150 acres.

Typically, the surface layer is brown sandy loam about 16 inches thick. The subsoil, from a depth of 16 to 48 inches, is strong brown fine sandy loam. The layer extending from 48 to 65 inches is light brown fine sandy loam. The soil is noncalcareous to 48 inches.

This soil is well drained. Surface runoff is slow, and permeability is moderately rapid. The available water capacity is medium. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thin surface layer because of cutting, and in a few areas all of the surface layer has been removed.

The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are small areas of Brennan, Comitas, Delmita, and McAllen soils. These soils make up less than 15 percent of this map unit.

This Hebbronville soil is used mostly as rangeland and nonirrigated cropland. A few areas are irrigated.

Potential is medium for nonirrigated crops and high for irrigated crops. Nonirrigated crops are cotton, grain sorghum, and watermelons. Irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. This soil has high potential for citrus if it is bench leveled.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, conserving soil moisture, and controlling soil blowing are necessary. Cropping systems that include high residue crops help to maintain soil tilth, reduce evaporation, provide organic matter, and control soil blowing. Land leveling reduces erosion and runoff and permits a better distribution of irrigation water. Bench leveling reduces the depth of required land-leveling cuts. Subsurface tile drainage lowers the high water table that can develop from irrigation if the soil is bench leveled. Temporary field ditches are difficult to maintain. If the soil has not been leveled, a properly designed sprinkler system helps to conserve water. When the soil is not irrigated, contour farming helps reduce soil losses from erosion. Stripcropping helps control soil blowing.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Improved bermudagrass, buffelgrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland. In open grassland, the dominant grasses in the potential plant community consist of fourflower trichloris, twoflower trichloris, and tanglehead; woody plants include desert yaupon and vine ephedra; and forbs include Engelmann-daisy and bushsunflower.

With continuous heavy grazing by livestock, fourflower trichloris, twoflower trichloris, and tanglehead decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, pink pappusgrass, whiplash pappusgrass, and slim tridens. If heavy grazing continues for many years, mesquite, condalias, pricklypear, and other woody plants form a dense canopy that has an understory of red lovegrass, threeawn, and sandburs. Brush encroachment on this soil is a major range management problem.

Potential is medium for habitat for deer and javelina. Nesting areas are plentiful for quail, doves, and songbirds.

Potential is high for urban uses and medium for recreation uses. The sandy surface layer limits recreation uses.

This Hebbronville soil is in capability subclass IIIe, nonirrigated and in subclass IIe, irrigated; it is in the Sandy Loam range site.

24—Hebbronville sandy loam, 3 to 5 percent slopes. This deep, gently sloping soil is on convex uplands. Areas are small and irregular in shape and range from 10 to 125 acres.

Typically, the surface layer is brown sandy loam about 20 inches thick. The subsoil, from 20 to 50 inches, is light yellowish brown fine sandy loam. The layer extending from 50 to 65 inches is light brown fine sandy loam. The soil is noncalcareous to 50 inches.

This soil is well drained. Surface runoff is slow, and permeability is moderately rapid. The available water capacity is medium. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thin surface layer because of cutting, and in a few areas all of the surface layer has been removed. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is severe, and the hazard of soil blowing is moderate.

Included with this soil in mapping are small areas of Brennan, Comitas, and McAllen soils. These soils make up less than 15 percent of this map unit.

This Hebbronville soil is used mostly as rangeland and nonirrigated cropland. A few areas are irrigated.

Potential is low for nonirrigated crops and medium for irrigated crops. Nonirrigated crops are cotton, grain sorghum, and watermelons. Irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. This soil has medium potential for citrus if it is bench leveled.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, conserving soil moisture, and controlling soil blowing are necessary. Cropping systems that include high residue crops help to maintain soil tilth, reduce evaporation, provide organic matter, and control soil blowing. Land leveling reduces erosion and runoff and permits a better distribution of irrigation water. Bench leveling reduces the depth of required land-leveling cuts. Subsurface tile drainage lowers the high water table that can develop from irrigation if the soil is bench leveled. If the soil has not been leveled, a properly designed sprinkler system helps to conserve water. When the soil is not irrigated, contour farming helps reduce soil losses from erosion. Stripcropping helps control soil blowing.

Potential is low for nonirrigated pasture grasses and medium for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Improved bermudagrass, buffelgrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland. In open grassland, the dominant grasses in the potential plant community consist of fourflower trichloris, twoflower trichloris, and tanglehead; woody plants include desert yaupon and

vine ephedra; and forbs include Engelmann-daisy and bushsunflower.

With continuous heavy grazing by livestock, fourflower trichloris, twoflower trichloris, and tanglehead decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, pink pappusgrass, whiplash pappusgrass, and slim tridens. If heavy grazing continues for many years, mesquite, condalias, pricklypear, and other woody plants form a dense canopy that has an understory of red lovegrass, threeawn, and sandburs. Brush encroachment on this soil is a major range management problem.

Potential is medium for habitat for deer and javelina. Nesting areas are plentiful for quail, doves, and songbirds.

Potential is high for urban uses and medium for recreation uses. Recreation uses are limited by the sandy surface layer.

This Hebbronville soil is in capability subclass IVe, nonirrigated and in subclass IIIe, irrigated; it is in the Sandy Loam range site.

25—Hidalgo fine sandy loam, 0 to 1 percent slopes. This deep, nearly level soil is on convex uplands. Areas are mostly broad and irregular in shape and range from 15 to 900 acres.

Typically, the surface layer is dark grayish brown fine sandy loam about 15 inches thick. The upper part of the subsoil, from 15 to 30 inches, is brown sandy clay loam. The lower part, from 30 to 39 inches, is pale brown sandy clay loam. The layer extending from 39 to 72 inches is very pale brown sandy clay loam. The soil is calcareous throughout.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and the available water capacity is medium. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thin surface layer because of cutting, in a few areas it has a thick surface layer because of filling, and in a few areas all of the surface layer has been removed. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is slight, and the hazard of soil blowing is moderate.

Included with this soil in mapping are small areas of Brennan and Willacy soils and Hidalgo soils that have a clay loam surface layer. The included soils make up less than 20 percent of this map unit.

This Hidalgo soil is used mostly as irrigated and nonirrigated cropland and for citrus.

This soil has high potential for nonirrigated and irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables (fig. 7). This soil has high potential for citrus.

Figure 7.—Irrigated cabbage on Hidalgo fine sandy loam, 0 to 1 percent slopes.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, conserving soil moisture are necessary. Cropping systems that include high residue crops help to maintain soil tilth, improve soil structure, reduce evaporation, control soil blowing, and provide organic matter. Land leveling reduces erosion and runoff and permits a better distribution of irrigation water. Subsurface tile drainage lowers the high water table that can develop from irrigation. Temporary field ditches are difficult to maintain. Stripcropping helps control soil blowing. The high lime content of this soil can cause chlorosis of some plants, especially in areas where the surface layer has been removed by land leveling. Applying mulch or manure helps offset the loss of organic matter caused by land leveling.

Potential is high for nonirrigated and irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Coastal bermudagrass, African stargrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland. In open grassland, the dominant grasses in the potential plant community consist of twoflower trichloris, fourflower trichloris, and plain bristlegrass; woody plants include spiny hackberry and kidneywood; and forbs include bundleflower and bushsunflower.

With continuous heavy grazing by livestock, twoflower trichloris, fourflower trichloris, and plains bristlegrass decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, pink pappusgrass, and lovegrass tridens. If heavy grazing continues for many years, whitebrush, lime pricklyash, mesquite, pricklypear, and other woody plants form a dense canopy that has an understory of tumblegrass, threeawn, ragweed, and sandburs. Brush encroachment on this soil is a major range management problem.

Potential is high for habitat for deer, javelina, and coyote. Nesting areas are plentiful for quail, doves, and songbirds.

Potential is medium for urban uses and high for recreation uses. The main limitation for urban uses is the high corrosivity to uncoated steel. Low strength is a limitation for local roads and streets.

This Hidalgo soil is in capability subclass IIc, nonirrigated and in class I, irrigated; it is in the Gray Sandy Loam range site.

26—Hidalgo fine sandy loam, 1 to 3 percent slopes. This deep, gently sloping soil is on convex uplands. Areas are small and irregular in shape and range from 10 to 200 acres.

Typically, the surface layer is dark grayish brown fine sandy loam about 17 inches thick. The upper part of the subsoil, to a depth of 37 inches, is brown sandy clay loam. The lower part, to a depth of 49 inches, is pale brown sandy clay loam. The layer extending to a depth of 65 inches is very pale brown sandy clay loam. The soil is calcareous throughout.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and the available water capacity is medium. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thin surface layer because of cutting, and in a few areas all of the surface layer has been removed. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are small areas of Brennan and Willacy soils and a Hidalgo soil that has a sandy clay loam surface layer. The included soils make up less than 15 percent of this map unit.

This Hidalgo soil is used mostly as irrigated and nonirrigated cropland and for citrus.

This soil has high potential for nonirrigated and irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. This soil has high potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, conserving soil moisture, and controlling erosion are necessary. Cropping systems that include high residue crops help to maintain or improve soil tilth, reduce evaporation, control soil blowing, and provide organic matter. Land leveling reduces erosion and runoff and permits a better distribution of irrigation water. Bench leveling reduces the depth of required land-leveling cuts. Subsurface tile drainage lowers the high water table that can develop from irrigation if the soil is leveled. Temporary field ditches are difficult to maintain. When this soil is not irrigated, contour farming helps reduce soil losses from erosion. Stripcropping helps control soil blowing. The high lime content of this soil can cause chlorosis of some plants, especially in areas where the surface layer has been removed by land leveling. Applying mulch or manure helps to offset the loss of organic matter from land leveling.

Potential is high for nonirrigated and irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Coastal bermudagrass, African stargrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland. In open grassland, the dominant grasses in the potential plant community consist of twoflower trichloris, fourflower trichloris, and plains bristlegrass; woody plants include spiny hackberry and kidneywood; and forbs include bundleflower and bushsunflower.

With continuous heavy grazing by livestock, twoflower trichloris, fourflower trichloris, and plains bristlegrass

pink pappusgrass, and lovegrass tridens. If heavy grazing continues for many years, whitebrush, lime pricklyash, mesquite, pricklypear, and other woody plants form a dense canopy that has an understory of tumblegrass, threeawn, ragweed, and sandburs. Brush encroachment on this soil is a major range management problem.

Potential is high for habitat for deer, javelina, and coyote. Nesting areas are plentiful for quail, doves, and songbirds.

Potential is medium for urban uses and high for recreation uses. The main limitation for urban uses is the high corrosivity for uncoated steel. Low strength is a limitation for local roads and streets.

This Hidalgo soil is in capability subclass IIe, nonirrigated and irrigated; it is in the Gray Sandy Loam range site.

27—Hidalgo fine sandy loam, 3 to 5 percent slopes. This deep, gently sloping soil is on convex uplands. Areas are small and irregular in shape and range from 5 to 175 acres.

Typically, the surface layer is dark grayish brown fine sandy loam about 16 inches thick. The upper part of the subsoil, from 16 to 27 inches, is grayish brown sandy clay loam. The lower part, from 27 to 37 inches, is brown sandy clay loam. The layer extending from 37 to 65 inches is pale brown sandy clay loam. The soil is calcareous throughout.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and the available water capacity is medium. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thin surface layer because of cutting, and in a few areas all of the surface layer has been removed. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is severe, and the hazard of soil blowing is moderate.

Included with this soil in mapping are small areas of Brennan, Delfina, and Willacy soils. The included soils make up less than 15 percent of this map unit.

This Hidalgo soil is used mostly as nonirrigated cropland, pastureland, or rangeland. A few areas are irrigated.

This soil has medium potential for nonirrigated and irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. When the soil is bench leveled, it has medium potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, controlling erosion, and conserving soil moisture are necessary. Cropping systems that include high residue crops help to maintain or improve soil tilth, reduce evaporation, control soil blowing, and provide organic matter. Land leveling reduces erosion and runoff and permits a better distribution of irrigation water. Bench leveling reduces the depth of required land leveling cuts. Subsurface tile drainage lowers the high water table that can develop from irrigation if the soil is bench leveled. If the soil has not been leveled, a properly designed sprinkler system helps to conserve water. When this soil is not irrigated, contour farming helps reduce soil losses from erosion. Stripcropping helps control soil blowing. The high lime content of this soil can cause chlorosis of some plants, especially in areas where the surface layer has been removed by land leveling. Applying mulch or manure helps to offset the loss of organic matter from land leveling.

Potential is medium for nonirrigated and irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Coastal bermudagrass, African stargrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland. In open grassland, the dominant grasses in the potential plant community consist of twoflower trichloris, fourflower trichloris, and plains bristlegrass; woody plants include spiny hackberry and kidneywood; and forbs include bundleflower and bushsunflower.

With continuous heavy grazing by livestock, twoflower trichloris, fourflower trichloris, and plains bristlegrass decrease in the plant community. These plants are replaced by less desirable hooded windmillgrass, pink pappusgrass, and lovegrass tridens. If heavy grazing continues for many years, whitebrush, lime pricklyash, mesquite, pricklypear, and other woody plants form a dense canopy that has an understory of threeawn, tumblegrass, and sandburs. Brush encroachment on this soil is a major range management problem.

Potential is high for habitat for deer, javelina, and coyote. Nesting areas are plentiful for doves, quail, and songbirds.

Potential is medium for urban uses and high for recreation uses. The main limitations are high corrosivity to uncoated steel and low strength for local roads and streets.

This Hidalgo soil is in capability subclass IIIe, nonirrigated and irrigated; it is in the Gray Sandy Loam range site.

28—Hidalgo sandy clay loam, 0 to 1 percent slopes. This deep, nearly level soil is on convex uplands. Areas are mostly broad and irregular in shape and range from 25 to more than 900 acres.

Typically, the surface layer is dark grayish brown sandy clay loam about 17 inches thick. The next layer, from 17 to 28 inches, is brown sandy clay loam. The next layer, from 28 to 38 inches, is pale brown clay loam. The layer extending from 38 to 80 inches is very pale brown sandy clay loam. The soil is calcareous throughout.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and the available water

capacity is high. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thin surface layer because of cutting, in a few areas it has a thick surface layer because of filling; and in a few areas all of the surface layer has been removed. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Raymondville and Willacy soils and Hidalgo soils that have a fine sandy loam surface layer. The included soils make up less than 20 percent of this map unit.

This Hidalgo soil is used mostly as irrigated and nonirrigated cropland and for citrus.

This soil has high potential for nonirrigated and irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. This soil has high potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, and providing adequate surface drainage are necessary. Cropping systems that include high residue crops help to maintain or improve soil tilth and provide organic matter. Land leveling reduces runoff and permits a better distribution of irrigation water. Surface drainage is useful in removing excess water after heavy rainfall. Subsurface tile drainage lowers the high water table that can develop from irrigation. The high lime content of this soil can cause chlorosis of some plants, especially in areas where the surface layer has been removed by land leveling. Applying mulch or manure helps offset the loss of organic matter from land leveling.

Potential is high for nonirrigated and irrigated pasture grasses (fig. 8). Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Coastal bermudagrass, African stargrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland. In open grassland, the dominant grasses in the potential plant community consist of twoflower trichloris, fourflower trichloris, and plains bristlegrass; woody plants include spiny hackberry and kidneywood; and forbs include bundleflower and bushsunflower.

With continuous heavy grazing by livestock, twoflower trichloris, fourflower trichloris, and plains bristlegrass decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, pink pappusgrass, and lovegrass tridens. If heavy grazing continues for many years, whitebrush, lime pricklyash,

Figure 8.—Irrigated Coastal bermudagrass on Hidalgo sandy clay loam, 0 to 1 percent slopes.

pricklypear, and other woody plants form a dense canopy that has an understory of threeawn, tumblegrass, and sandburs. Brush encroachment on this soil is a major range management problem.

Potential is high for habitat for deer, javelina, and coyote. Nesting areas are plentiful for doves, quail, and songbirds.

Potential is medium for urban uses and high for recreation uses. The main limitations are shrinking and swelling of the soil and high corrosivity to uncoated steel.

This Hidalgo soil is in capability subclass IIc, nonirrigated and in class I, irrigated; it is in the Gray Sandy Loam range site.

29—Hidalgo sandy clay loam, 1 to 3 percent slopes. This deep, gently sloping soil is on convex uplands. Areas are small and irregular in shape and range from 5 to 150 acres.

Typically, the surface layer is dark brown sandy clay loam about 14 inches thick. The next layer, from 14 to 36 inches, is brown sandy clay loam. The layer extending from 36 to 72 inches is pale brown sandy clay loam. The soil is calcareous throughout.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and the available water capacity is high. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thin surface layer because of cutting, and in a few areas all of the surface layer has been removed. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Willacy soils and Hidalgo soils that have a fine sandy loam surface layer. The included soils make up less than 15 percent of this map unit.

This soil is used mostly as irrigated and nonirrigated cropland and for citrus.

This soil has high potential for nonirrigated and irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. This soil has high potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, and controlling erosion are necessary. Cropping systems that include high residue crops help maintain or improve soil tilth, reduce evaporation, and provide organic matter. Land leveling reduces erosion and runoff and permits a better distribution of irrigation water. Bench leveling reduces the depth of required land-leveling cuts. Subsurface tile drainage lowers the high water tables that can develop from irrigation when the soil is leveled. When this soil is not irrigated, contour farming helps reduce soil erosion. The high lime content of this soil can cause chlorosis of some plants, especially in areas where the surface layer has been removed by land leveling. Applying mulch or manure helps offset the loss of organic matter from land leveling.

Potential is high for nonirrigated and irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Coastal bermudagrass, African stargrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland. In open grassland, the dominant grasses in the potential plant community consist of twoflower trichloris, fourflower trichloris, and plains bristlegrass; woody plants include spiny hackberry and kidneywood; and forbs include bundleflower and bushsunflower.

With continuous heavy grazing by livestock, twoflower trichloris, fourflower trichloris, and plains bristlegrass decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, pink pappusgrass, and lovegrass tridens. If heavy grazing continues for many years, whitebrush, lime pricklyash, pricklypear, and other woody plants form a dense canopy that has an understory of threeawn, tumblegrass, and sandburs. Brush encroachment on this soil is a major range management problem.

Potential is high for habitat for deer, javelina, and coyote. Nesting areas are plentiful for doves, quail, and songbirds.

Potential is medium for urban uses and high for recreation uses. The main limitations are shrinking and swelling of the soil and high corrosivity to uncoated steel.

This Hidalgo soil is in capability subclass IIe, nonirrigated and irrigated; it is in the Gray Sandy Loam range site.

30—Hidalgo sandy clay loam, saline, 0 to 1 percent slopes. This deep, nearly level saline soil is on convex uplands. Areas are small and irregular in shape and range from 25 to 100 acres.

Typically, the surface layer is saline, dark grayish brown sandy clay loam about 15 inches thick. The next layer, from 15 to 25 inches, is saline, brown sandy clay loam. The next layer, from 25 to 36 inches, is saline, pale brown clay loam. The layer extending from 36 to 65 inches is saline, very pale brown sandy clay loam. The soil is calcareous throughout.

This soil is well drained. Surface runoff is slow, and permeability is moderate. The available water capacity is low. This soil is moderately saline to strongly saline as a result of overirrigation and evaporation of slightly saline water. A high water table that is saline occurs at depths from 1 1/2 to 4 1/2 feet below the surface. A few areas of this soil have been altered by land leveling for irrigation. In these areas, the soil has a thin surface layer because of cutting; in a few areas, it has a thick surface layer because of filling; and in a few areas all of the surface layer has been removed. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of saline Raymondville and saline Racombes soils. Also included are a few nonsaline areas of Hidalgo, Raymondville, and Racombes soils. The included soils make up less than 15 percent of this map unit.

This Hidalgo soil is used mostly as irrigated cropland or pastureland. A few areas are idle.

This soil has low potential for nonirrigated and irrigated cropland. Because of salinity, careful selection of crops is necessary. Suitable crops are cotton and grain sorghum. This soil is not suitable for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, providing adequate surface and subsurface drainage, and adapting cropping systems to the soil limitations are necessary. Cropping systems that include high residue crops help to maintain or improve soil tilth and provide organic matter. Mulches, such as cotton burrs, help reduce the evaporation that brings harmful salts to the surface. Land leveling reduces runoff and permits a better distribution of irrigation water. Surface drainage is useful in removing excess water after a heavy rainfall. Subsurface tile drainage lowers the high water table and provides uniform leaching of harmful salts. The high lime content of this soil can cause chlorosis of some plants, especially in areas where the surface layer has been removed by land leveling. Applying mulch or manure helps to offset the loss of organic matter from land leveling.

Potential is low for nonirrigated pasture grasses and medium for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain the vigor of established grass. Coastal bermudagrass, African stargrass, introduced bluestems, and similar grasses are suited to this soil. Establishing grass is difficult, especially from seed. Subsurface tile drainage lowers the seasonal high water table and removes excess soluble salts.

Potential is low for rangeland. No areas of this soil are in rangeland. Potential is low for wildlife habitat including habitat for doves, quail, and furbearing animals.

Potential is low for urban use and recreation use. The main limitations are wetness and high corrosivity to steel.

This Hidalgo soil is in capability subclass IVs, nonirrigated and irrigated. It is not assigned a range site.

31—Hidalgo-Urban land complex, 0 to 3 percent slopes. This map unit consists of nearly level to gently sloping Hidalgo soil and Urban land in areas that are so intricately mixed that to separate them at the scale used for mapping was not practical. Areas are broad and irregular in shape and range in size from 10 to 900 acres or more. Boundaries commonly coincide with the outer limits of subdivisions, built up areas, and cities.

Hidalgo soil makes up 35 to 80 percent of this map unit, Urban land 15 to 55 percent, and other soils 5 to 10 percent.

Typically, Hidalgo soil has a surface layer of dark grayish brown sandy clay loam about 11 inches thick. The next layer, from 11 to 38 inches, is grayish brown sandy clay loam. The layer extending from 38 to 65 inches is very pale brown sandy clay loam. In some areas the surface layer is fine sandy loam. The soil is calcareous throughout.

Urban land consists of areas that are covered by buildings and other urban structures, which make their classification impractical. Typical structures are single or multiple-unit dwellings, garages, sidewalks, patios, driveways, streets, schools, churches, shopping centers on less than 40 acres, office buildings, paved parking lots, and industrial sites. Some areas of the Hidalgo soil have been altered by cutting, grading, and filling over the surface layer with 6 to 24 inches of loamy material.

Included in mapping are areas of Racombes, Raymondville, and Willacy soils.

Although the Hidalgo soil and Urban land are used for urban structures, their potential for this use is medium. The main limitations are moderate shrink-swell potential and high corrosivity for uncoated steel. Potential is high for landscaping and gardening. Most flowers, shrubs, and trees are well suited to this soil. However, the high lime content of this soil can cause chlorosis of some plants, such as avocados and citrus. Iron sulfate or iron chelates can be added to temporarily correct this condition.

This map unit was not assigned to a subclass or range site.

32—Jimenez-Quemado complex, 1 to 8 percent slopes. This map unit consists of very shallow to shallow, gently sloping Jimenez and Quemado soils that are so intricately mixed that separating them at the scale used for mapping was not practical. These soils are on convex uplands. Areas are small, dissected, and irregular in shape and range from 25 to 50 acres.

Jimenez very gravelly loam makes up about 60 percent of the map unit, and Quemado very gravelly sandy loam makes up about 30 percent.

Typically, Jimenez soil has a surface layer of brown very gravelly loam about 8 inches thick. The underlying material to about 10 inches is indurated caliche that is about 35 percent, by volume, embedded siliceous gravel. Below that, the material is mostly cemented caliche that is about 50 percent embedded siliceous gravel. The soil is calcareous throughout.

Jimenez soil is excessively drained. Surface runoff is medium, and permeability is moderate. The available water capacity is very low. The root zone is very shallow. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Typically, Quemado soil has a surface layer of dark brown very gravelly sandy loam about 6 inches thick. The next layer, from 6 to 12 inches, is brown very gravelly sandy clay loam. The underlying material to about 18 inches is indurated caliche that is about 40 percent, by volume, embedded siliceous gravel. Below that, the material is weakly cemented caliche that is

about 50 percent embedded siliceous gravel. The soil is noncalcareous above the caliche.

Quemado soil is well drained. Surface runoff is medium, and permeability is moderate. Available water capacity is very low. The root zone is very shallow. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included in mapping are small areas of Ramadero, Brennan, and McAllen soils. These soils are in slightly lower positions. The included soils make up 10 percent or less of this map unit.

These Jimenez and Quemado soils are used as rangeland or are mined commercially for gravel. They are not suited to use as cropland.

Potential is low for rangeland. In open grassland, the potential plant community for Jimenez and Quemado soils consists of grasses, including tanglehead, Arizona cottontop, and sideoats grama; woody plants, including kidneywood and vine ephedra; and forbs, including orange zexmenia and bushsunflower.

With continuous heavy grazing by livestock, tanglehead, Arizona cottontop, and sideoats grama decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, pinhole bluestem, and slim tridens. If heavy grazing continues for many years, Texas bristlegrass, threeawn, guajillo, blackbrush, cenizo, and other woody plants dominate the site.

Potential is low for wildlife habitat including habitat for deer, javelina, doves, and quail.

These Jimenez and Quemado soils are in capability subclass VIIs, nonirrigated, and in the Gravelly Ridge range site.

33—Laredo silty clay loam. This deep, nearly level soil is on ancient stream terraces. Slopes range from 0 to 1 percent. Areas are small and irregular in shape and range from 10 to 75 acres.

Typically, the surface layer is dark grayish brown silty clay loam about 14 inches thick. The next layer, from 14 to 47 inches, is brown silt loam. The underlying layer extending from 47 to 65 inches is pale brown very fine sandy loam. The soil is calcareous throughout.

This soil is well drained. Surface runoff is slow, and permeability is moderate. The available water capacity is high. A few areas of this soil have been altered by land leveling for irrigation. In these areas this soil has a thin surface layer because of cutting, in a few areas it has a thick surface layer because of filling, and in some areas all of the surface layer has been removed. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Cameron, Olmito, and Reynosa soils. These soils make up less than 15 percent of this map unit.

This Laredo soil is used almost entirely as irrigated cropland.

The soil has high potential for nonirrigated and irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. This soil has high potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, and providing surface drainage are necessary. Cropping systems that include high residue crops help maintain or improve soil tilth and provide organic matter. Land leveling reduces runoff and permits a better distribution of irrigation water. The high lime content of this soil can cause chlorosis of some plants, especially in areas where the surface layer has been removed by land leveling. Applying mulch or manure helps to offset the loss of organic matter from land leveling.

Potential is high for nonirrigated and irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain plant vigor. Coastal bermudagrass, African stargrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland, although no acreage is used as such. Most of this soil has been cleared and is continuously cropped; however, a few areas remain undisturbed. Potential in these areas is high for wildlife habitat including habitat for coyote, weasel, and armadillo. Nesting areas are plentiful for white-winged doves, chachalaca, songbirds, and many migratory birds.

Potential is medium for urban use and high for recreation use. Shrinking and swelling of the soil is the main limitation.

This Laredo soil is in capability subclass IIc, nonirrigated and in class I, irrigated; it is in the Loamy Bottomland range site.

34—Matamoros silty clay. This deep, nearly level soil is on the active flood plain of the Rio Grande. Slope is mainly less than 0.5 percent but ranges from 0 to 1 percent. Areas are irregular in shape and range from 10 to 50 acres.

Typically, the surface layer is grayish brown, silty clay about 7 inches thick. The next layer, from 7 to 22 inches, is light brownish gray silty clay that has a few faint yellowish brown mottles in the lower part. The next layer, from 22 to 26 inches, is an old buried surface layer of grayish brown silty clay. The underlying layer extending from 26 to 65 inches is light brownish gray silty clay. Thin strata of contrasting textures occur throughout the soil. The soil is calcareous throughout. In a few areas the soil is underlain by loamy material at a depth of 25 to 40 inches.

This soil is moderately well drained. Surface runoff is slow. Permeability is slow, and the available water capacity is high. This soil is occasionally flooded following tropical storms. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thick surface layer because of filling. In a few areas, it has a thin surface layer because of cutting. The rooting zone is deep but is hard for plant roots to penetrate. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Camargo and Rio Grande soils. The included soils make up less than 15 percent of this map unit.

This Matamoros soil is used almost entirely as irrigated cropland.

Potential is medium for nonirrigated crops and high for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, and cool and warm season vegetables. This soil has medium potential for sugarcane. The soil is not suitable for citrus.

If this soil is used as cropland, maintaining or improving soil tilth and managing irrigation water are necessary. Cropping systems that include high residue crops help to improve and maintain soil tilth. Land leveling increases the efficiency of irrigation and permits a better distribution of irrigation water.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Coastal bermudagrass, African stargrass, and similar grasses are suited to this soil.

Potential is high for rangeland, although no acreage is used as such. Most of this soil has been cleared and is continuously cropped; however, a few areas remain undisturbed. Potential is high in these areas for wildlife habitat including habitat for coyote, weasel, and armadillo, white-winged doves, chachalaca, and many migratory birds.

Potential is low for urban and recreation uses because of the hazard of flooding.

This Matamoros soil is in capability subclass IIs, nonirrigated and irrigated; it is in the Clayey Bottomland range site.

35—McAllen fine sandy loam, 0 to 1 percent slopes. This deep, nearly level soil is on convex uplands. Areas are broad and irregular in shape and range from 25 to more than 350 acres.

Typically, the surface layer is light brownish gray fine sandy loam about 14 inches thick. The next layer, from 14 to 37 inches, is pale brown sandy clay loam. The layer extending from 37 to 72 inches is very pale brown sandy clay loam. The soil is calcareous throughout.

This soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is medium. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thin surface layer because of cutting, in a few areas it has a thicker surface layer because of filling, and in a few areas all of the surface layer has been removed. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is slight, and the hazard of soil blowing is moderate.

Included with this soil in mapping are small areas of Brennan, Delmita, Ramadero, and Rio soils. The included soils make up less than 15 percent of this map unit.

This McAllen soil is used mostly as nonirrigated and irrigated cropland, as rangeland, and for citrus.

Potential is medium for nonirrigated crops and high for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. This soil has medium potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, and conserving soil moisture are necessary. Cropping systems that include high residue crops help to maintain or improve soil tilth, reduce evaporation, provide organic matter, and control soil blowing. Land leveling reduces erosion and runoff and permits better distribution of irrigation water. Surface tile drainage lowers the high water table that can develop from irrigation. Temporary field ditches are difficult to maintain. The high lime content of this soil can cause chlorosis of some plants, especially in areas where the surface layer has been removed by land leveling operations. Applying mulch or manure helps to offset the loss of organic matter from land leveling.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain productivity. Buffelgrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland. In open grassland, the dominant grasses in the potential plant community consist of plains bristlegrass, Arizona cottontop, and twoflower trichloris; woody plants include vine ephedra and kidneywood; and forbs include bundleflower and bushsunflower.

With continuous heavy grazing by livestock, plains bristlegrass, Arizona cottontop, and twoflower trichloris decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, pink pappusgrass, and fall witchgrass. If heavy grazing continues for many years, whitebrush, lime pricklyash, pricklypear, and other woody plants form a dense canopy that has an understory of treeawn, tumblegrass, and sandburs. Brush encroachment on this soil is a major range management problem.

Potential is high for wildlife habitat including habitat for deer and javelina. Nesting areas are plentiful for doves, quail, and songbirds.

Potential is medium for urban use and high for recreation use. Shrinking and swelling of the soil is the main limitation for urban use.

This McAllen soil is in capability subclass IIIc, nonirrigated and in class I, irrigated; it is in the Gray Sandy Loam range site.

36—McAllen fine sandy loam, 1 to 3 percent slopes. This deep, gently sloping soil is on convex uplands. Areas are broad and irregular in shape and range from 25 to more than 250 acres.

Typically, the surface layer is grayish brown fine sandy loam about 18 inches thick. The next layer, from 18 to

39 inches, is pale brown sandy clay loam. The underlying layer extending from 39 to 65 inches is very pale brown sandy clay loam. The soil is calcareous throughout.

This soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is medium. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thin surface layer because of cutting, and in a few areas all of the surface layer has been removed. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are small areas of Brennan and Delmita soils. The included soils make up less than 15 percent of this map unit.

This McAllen soil is used mostly as nonirrigated and irrigated cropland, as rangeland, and for citrus.

Potential is medium for nonirrigated crops and high for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. This soil has medium potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, conserving soil moisture, and controlling erosion are necessary. Cropping systems that include high residue crops help to maintain or improve soil tilth, reduce evaporation, provide organic matter, and control soil blowing. Land leveling reduces erosion and runoff and permits a better distribution of irrigation water. Bench leveling reduces the depth of required land-leveling cuts. Subsurface tile drainage lowers the high water table that can develop from irrigation if the soil is leveled. Temporary field ditches are difficult to maintain. When the soil is not irrigated, contour farming helps reduce soil losses from erosion. Stripcropping helps control soil blowing. The high lime content of this soil can cause chlorosis of some plants, especially in areas where the surface layer has been removed by land leveling. Applying mulch or manure helps to offset the loss of organic matter from land leveling.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Buffelgrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland. In open grassland, the dominant grasses in the potential plant community consist of plains bristlegrass, Arizona cottontop, and twoflower trichloris; woody plants include vine ephedra and kidneywood; and forbs include bundleflower and bushsunflower.

With continuous heavy grazing by livestock, plains bristlegrass, Arizona cottontop, and twoflower trichloris decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, pink pappusgrass, and fall witchgrass. If heavy grazing continues for many years, whitebrush, lime pricklyash, pricklypear, and other woody plants form a dense canopy that has an understory of threeawn, tumblegrass, and sandburs. Brush encroachment on this soil is a major range management problem.

Potential is high for wildlife habitat including habitat for deer and javelina. Nesting areas are plentiful for doves, quail, and songbirds.

Potential is medium for urban uses and high for recreation uses. Shrinking and swelling of the soil is a limitation to urban uses.

This McAllen soil is in capability subclass IIIe, nonirrigated and in IIe, irrigated; it is in the Gray Sandy Loam range site.

37—McAllen fine sandy loam, 3 to 5 percent slopes. This deep, gently sloping soil is on convex uplands. Areas are small and irregular in shape and range from 15 to 150 acres.

Typically, the surface layer is grayish brown fine sandy loam about 18 inches thick. The next layer, from 18 to 38 inches, is pale brown sandy clay loam. The layer extending from 38 to 65 inches is very pale brown sandy clay loam. The soil is calcareous throughout.

This soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is medium. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thin surface layer because of cutting, and in a few areas all of the surface layer has been removed. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is severe, and the hazard of soil blowing is moderate.

Included with this soil in mapping are small areas of Brennan and Delmita soils. The included soils make up less than 15 percent of this map unit.

This McAllen soil is used mostly as nonirrigated cropland and rangeland. A few areas of this soil are irrigated.

Potential is low for nonirrigated crops and medium for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. When this soil is bench leveled, it has medium potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, conserving soil moisture, and controlling erosion are necessary. Cropping systems that include high residue crops help to maintain or improve soil tilth, reduce evaporation, provide organic matter, and control soil blowing. Land leveling reduces erosion and runoff and permits a better distribution of irrigation water. Bench leveling reduces the depth of required land-leveling cuts. Subsurface tile drainage lowers the high water table that can develop from irrigation if the soil is bench leveled. If the soil has not been leveled, a properly designed sprinkler system helps to conserve water. When the soil is not irrigated, contour farming helps reduce soil losses from erosion.

Stripcropping helps control soil blowing. The high lime content of this soil can cause chlorosis of some plants, especially in areas where the surface layer has been removed by land leveling. Applying mulch or manure helps to offset the loss of organic matter from land leveling.

Potential is low for nonirrigated pasture grasses and medium for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Buffelgrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is medium for rangeland. In open grassland, the dominant grasses in the potential plant community consist of plains bristlegrass, Arizona cottontop, and twoflower trichloris; woody plants include vine ephedra and kidneywood; and forbs include bundleflower and bushsunflower.

With continuous heavy grazing by livestock, plains bristlegrass, Arizona cottontop, and twoflower trichloris decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, pink pappusgrass, and fall witchgrass. If heavy grazing continues for many years, whitebrush, lime pricklyash, pricklypear, and other woody plants form a dense canopy that has an understory of threeawn, tumblegrass, and sandburs. Brush encroachment on this soil is a major range management problem.

Potential is high for wildlife habitat including habitat for deer and javelina. Nesting areas are plentiful for doves, quail, and songbirds.

Potential is medium for urban uses and high for recreation uses. The main limitations are shrinking and swelling of the soil for urban uses and excess slope for recreation uses.

This McAllen soil is in capability subclass IVe, nonirrigated and in IIIe, irrigated; it is in the Gray Sandy Loam range site.

38—McAllen sandy clay loam, 0 to 1 percent slopes. This deep, nearly level soil is on convex uplands. Areas are broad and irregular in shape and range from 25 to more than 250 acres.

Typically, the surface layer is dark brown sandy clay loam about 14 inches thick. The next layer, from 14 to 36 inches, is pale brown sandy clay loam. The layer extending from 36 to 65 inches is very pale brown sandy clay loam. The soil is calcareous throughout.

This soil is well drained. Surface runoff is slow, and permeability is moderate. The available water capacity is medium. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thin surface layer because of cutting, in a few areas it has a thick surface layer because of filling, and in a few areas all of the surface layer has been removed. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Brennan and Ramadero soils and McAllen soils that have a fine sandy loam surface layer. The included soils make up less than 15 percent of this map unit.

This soil is used mostly as irrigated and nonirrigated cropland, as rangeland, and for citrus.

Potential is medium for nonirrigated crops and high for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. This soil has medium potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, providing adequate surface drainage, and conserving soil moisture are necessary. Cropping systems that include high residue crops help to maintain or improve soil tilth, reduce evaporation, and provide organic matter. Surface drainage is useful in removing excess water after a heavy rainfall. Land leveling reduces erosion and runoff and permits a better distribution of irrigation water. Subsurface tile drainage lowers the high water table that can develop from irrigation. The high lime content of this soil can cause chlorosis of some plants, especially in areas where the surface layer has been removed by land leveling. Applying mulch or manure helps offset the loss of organic matter from land leveling.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Buffelgrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland. In open grassland, the dominant grasses in the potential plant community consist of plains bristlegrass, Arizona cottontop, and twoflower trichloris; woody plants include vine ephedra and kidneywood; and forbs include bundleflower and bushsunflower.

With continuous heavy grazing by livestock, plains bristlegrass, Arizona cottontop, and twoflower trichloris decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, pink pappusgrass, and fall witchgrass. If heavy grazing continues for many years, whitebrush, lime pricklyash, pricklypear, and other woody plants form a dense canopy that has an understory of threeawn, tumblegrass, and sandburs. Brush encroachment on this soil is a major range management problem.

Potential is high for wildlife habitat including habitat for deer and javelina. Nesting areas are plentiful for doves, quail, and songbirds.

Potential is medium for urban uses and high for recreation uses. Shrinking and swelling of the soil is a limitation to urban uses.

This McAllen soil is in capability subclass IIIc, nonirrigated and in class I, irrigated; it is in the Gray Sandy Loam range site.

39—Mercedes clay, 0 to 1 percent slopes. This deep, nearly level soil is on plane to slightly concave

uplands. Slopes are mainly less than 0.5 percent. Areas are broad and irregular in shape and range from 25 to more than 350 acres.

Typically, the surface layer is gray clay about 30 inches thick. It has many intersecting slickensides in the lower part. The next layer, from 30 to 57 inches, is light brownish gray clay. It also has many intersecting slickensides. The layer extending from 57 to 65 inches is pale brown clay. The soil is calcareous throughout.

This soil is moderately well drained. Surface runoff is very slow. Permeability is very slow. The available water capacity is medium. When the soil is dry, water enters rapidly through the cracks, but when the soil is wet and cracks are sealed, it enters very slowly. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thick surface layer because of filling, and in a few areas it has a thin surface layer because of cutting. The root zone is deep but is not easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Hidalgo and Raymondville soils. These soils make up less than 15 percent of this map unit.

This Mercedes soil is used mostly as irrigated and nonirrigated cropland.

Potential is medium for nonirrigated crops and high for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, and cool and warm season vegetables. This soil has a low potential for sugarcane. This soil is not suitable for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, and providing adequate surface drainage are necessary. Cropping systems that include high residue crops help improve or maintain soil tilth. Land leveling increases the efficiency of irrigation and permits a better distribution of irrigation water. Surface drainage is needed to remove excess water after a heavy rainfall. Subsurface tile drainage is not practical because of the high clay content of this soil.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Coastal bermudagrass, African stargrass, and introduced bluestems are suited to this soil.

Potential is medium for rangeland, although no acreage is used as such. Most of this soil has been cleared and is continuously cultivated; however, a few areas remain undisturbed. Potential is medium in these areas for wildlife habitat including habitat for coyote, weasel, armadillo, white-winged doves, quail, and songbirds.

Potential is low for urban and recreation uses. Shrinking and swelling of the soil and the clayey surface layer are the main limitations.

This Mercedes soil is in capability subclass IIIs, nonirrigated and irrigated; it is in the Clay Flat range site.

40—Mercedes clay, saline, 0 to 1 percent slopes. This deep, nearly level, saline soil is on plane to slightly concave uplands. Slopes are mainly less than 0.5 percent. Areas are broad and irregular in shape and range from 15 to over 200 acres.

Typically, the surface layer is saline, gray clay about 26 inches thick that has many intersecting slickensides in the lower part. The next layer, from 26 to 64 inches is saline, light brownish gray clay that has many intersecting slickensides. The layer extending from 64 to 72 inches is saline, very pale brown clay. The soil is calcareous throughout.

This soil is moderately well drained. Surface runoff is very slow. Permeability is very slow, and available water capacity is very low. This soil is moderately saline to strongly saline as a result of overirrigation and evaporation of slightly saline water. When the soil is dry, water enters rapidly through the cracks, but when the soil is wet and cracks are sealed, it enters very slowly. A few areas of this soil have been altered by land leveling for irrigation. In these areas this soil has a thick surface layer because of cutting. The root zone is deep but is not easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of saline Hidalgo and saline Raymondville soils. Also included are a few nonsaline areas of Hidalgo, Raymondville, and Mercedes soils. The included soils make up less than 15 percent of this map unit.

This Mercedes soil is used mostly as irrigated cropland or pastureland. A few areas are idle.

This soil has a low potential for nonirrigated and irrigated cropland. Because of salinity, careful selection of crops is necessary. Suitable crops are cotton and grain sorghum. This soil is not suitable for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, providing surface drainage, and adapting cropping systems to the soil limitations are necessary. Cropping systems that include high residue crops help to improve or maintain soil tilth and reduce evaporation. Mulches, such as cotton burrs, help reduce evaporation that brings harmful salts to the surface. Land leveling increases the efficiency of irrigation and permits a better distribution of irrigation water. Surface drainage is needed to remove excess water after a heavy rainfall. Subsurface tile drainage is not practical to leach out harmful salts because of the high clay content of this soil.

Potential is low for nonirrigated pasture grasses and medium for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain established grass. Coastal bermudagrass, African stargrass, and introduced bluestems are suited to this soil. Establishing grass is difficult, especially from seed. If pasture is grazed when the surface is wet, this soil puddles. Surface drainage is useful in removing excess water after a heavy rainfall.

Potential is low for rangeland. No areas of this soil are used as rangeland. Potential is low for habitat for doves,

quail, and furbearing animals because little plant cover or food is available.

Potential is low for urban and recreation uses. Shrinking and swelling of the soil, the clayey surface layer, very slow permeability, and corrosivity to uncoated steel are the main limitations.

This Mercedes soil is in capability subclass IVs, nonirrigated and irrigated. It is not assigned to a range site.

41—Mercedes clay, 1 to 5 percent slopes, gullied. This deep, gently sloping, eroded soil is on convex slopes of the Arroyo Colorado. Most areas are less than 300 feet wide. Areas range from 10 to 75 acres.

Typically, the surface layer is gray clay about 7 inches thick. The next layer, from 7 to 50 inches, is light brownish gray clay that has many intersecting slickensides. From 50 to 60 inches, it is pale brown clay. The layer extending from 60 to 72 inches is stratified loamy sediments. The soil is calcareous throughout.

This soil is moderately well drained. Surface runoff is rapid. Permeability is very slow. The available water capacity is medium. When the soil is dry, water enters rapidly through the cracks, but when the soil is wet and cracks are sealed, it enters very slowly. Gullies along the Arroyo are V-shaped, are from 3 to 10 feet deep, and are at intervals from 50 to 600 feet apart. The root zone is deep but is not easily penetrated by plant roots. Water erosion is a severe hazard, and soil blowing is a slight hazard.

Included with this soil in mapping are small areas of Hidalgo, Raymondville, and Harlingen soils. These soils make up less than 15 percent of this map unit.

This Mercedes soil is used mostly as pastureland or is left idle. This soil is not suited to cultivation.

Potential is low for pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain plant vigor. Coastal bermudagrass, African stargrass, and introduced bluestems are suited to this soil.

Potential is low for rangeland. None of this soil is used as rangeland. Potential is medium for habitat for doves, quail, and furbearing animals.

Potential is low for urban and recreation uses. Flooding, shrinking and swelling of the soil, and the clayey surface layer are the main limitations. In addition, the gullies in this map unit may affect potential urban and recreational uses.

This Mercedes soil is in capability subclass VIe, nonirrigated. It is not assigned to a range site.

42—Nueces fine sand, 0 to 3 percent slopes. This deep, nearly level to gently sloping soil is on convex uplands. Areas are broad and irregular in shape and range from 50 to more than 1,000 acres.

Typically, the surface layer is fine sand about 29 inches thick. The upper part is brown and the lower part is light brown. The subsoil, from 29 to 42 inches, is brown sandy clay loam that has red and dark grayish brown mottles. The next layer, from 42 to 54 inches, is light brown sandy clay loam that has yellowish red and yellow mottles. The layer extending from 54 to 72 inches is very pale brown sandy clay loam. The soil is noncalcareous throughout.

This soil is moderately well drained. Surface runoff is very slow, and permeability is moderately slow. The available water capacity is medium. This soil is saturated above the subsoil after heavy rainfall for a short time during the fall and spring. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is severe.

Included with this soil in mapping are small areas of Comitas, Delfina, and Sarita soils. The included soils make up less than 25 percent of this map unit.

This Nueces soil is used mainly as rangeland. A few areas of this soil are used as nonirrigated and sprinkler irrigated cropland.

Potential is low for nonirrigated pasture grasses and medium for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain established plants. Improved bermudagrass and weeping lovegrass are suited to this soil. Loose sandy seedbeds and the cutting action of blowing sand make establishing grass difficult.

Potential is medium for rangeland. In open grassland, the dominant grasses in the potential plant community consist of seacoast bluestem, brownseed paspalum, and indiangrass; woody plants include mesquite and pricklypear; and forbs include snoutbean and sensitivebrier.

With continuous heavy grazing by livestock, seacoast bluestem, brownseed paspalum, and indiangrass decrease in the plant community. These plants are replaced by the less desirable fringeleaf paspalum, gulfdune paspalum, and balsamscale. If heavy grazing continues for many years, red lovegrass, fringed threeawn, sandburs, and crotons will dominate the site. Woody plants increase only slightly.

Potential is medium for habitat for deer, javelina, doves, and quail because of insufficient plant cover.

Potential is low for urban and recreation uses. The main limitation is the sandy surface layer.

This Nueces soil is in capability subclass IVe, nonirrigated, and in IIIe, irrigated; it is in the Sandy range site.

43—Nueces-Sarita complex, 0 to 3 percent slopes. This map unit consists of deep, nearly level to gently sloping soils that are so intricately mixed that separating them was not practical because of the scale used in mapping. These soils are on convex uplands. Areas are broad and irregular in shape and range from 100 to more than 1,000 acres.

Nueces fine sand makes up about 50 percent of the unit, and Sarita fine sand makes up about 40 percent.

Typically, the Nueces soil has a surface layer of pale brown fine sand about 29 inches thick. The subsoil, from 29 to 49 inches, is grayish brown sandy clay loam that has reddish and dark grayish brown mottles. The next layer, from 49 to 58 inches, is light brown sandy clay loam. The layer extending from 58 to 72 inches is light yellowish brown sandy clay loam. The soil is noncalcareous throughout.

The Nueces soil is moderately well drained. Surface runoff is very slow, and permeability is moderately slow. The available water capacity is medium. This soil is saturated above the subsoil after a heavy rainfall for a short period during the fall and spring. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is severe.

Typically, the Sarita soil has a surface layer of fine sand about 48 inches thick. The upper part is grayish brown and the lower part is very pale brown. The next layer, from 48 to 65 inches, is light brownish gray sandy clay loam that has reddish and dark grayish brown mottles. The layer extending to a depth of 72 inches is light gray sandy clay loam.

The Sarita soil is well drained. Surface runoff is very slow, and permeability is moderately rapid. Available water capacity is low. In the fall and spring, this soil is saturated to a depth of 48 inches for a short period after a heavy rainfall. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is severe.

Included in mapping are small areas of Comitas and Falfurrias soils. These soils are on slightly higher positions. The included soils make up 10 percent of this map unit.

These Nueces and Sarita soils are used mainly as rangeland. In a few areas they are used as nonirrigated cropland.

These soils have low potential for nonirrigated pasture grasses and medium potential for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed in maintaining the established plants. The soils are suited to improved bermudagrass and weeping lovegrass. Loose sandy seedbeds and the cutting action of blowing sand make establishing grass difficult.

Potential is medium for rangeland. In open grassland, the dominant grasses in the potential plant community consist of seacoast bluestem, brownseed paspalum, and indiangrass; woody plants include mesquite and pricklypear; and forbs include snoutbean and sensitivebrier.

With continuous heavy grazing by livestock, seacoast bluestem, brownseed paspalum, and indiangrass decrease in the plant community. These plants are replaced by the less desirable fringeleaf paspalum, gulfdune paspalum, and balsamscale. If heavy grazing continues for many years, red lovegrass, threeawn, sandburs, and crotons will dominate the site. Woody plants increase only slightly.

Potential is medium for habitat for deer, javelina, doves, and quail because little plant cover and food is available.

Potential is low for urban and recreation uses. These uses are limited by the sandy surface layer.

These Nueces and Sarita soils are in capability subclass IVe, nonirrigated, and in IIIe, irrigated; they are in the Sandy range site.

44—Olmito silty clay. This deep, nearly level soil is on areas of ancient stream terraces. Slopes are mainly less than 0.5 percent, but range from 0 to 1 percent. Areas are small and irregular in shape and range from 10 to 250 acres.

Typically, the surface layer is dark gray silty clay about 24 inches thick. The next layer, from 24 to 47 inches, is grayish brown silty clay. The next layer, from 47 to 55 inches, is pale brown silty clay loam that has a few calcium carbonate concretions. The layer extending from 55 to 65 inches is pale brown silt loam. The soil is calcareous throughout.

This soil is moderately well drained. Surface runoff is slow. Permeability is slow, and available water capacity is medium. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thick surface layer because of filling, and in a few areas it has a thin surface layer because of cutting. The root zone is deep but is not easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Laredo, Cameron, and Harlingen soils. These soils make up less than 15 percent of this map unit.

This Olmito soil is used entirely as irrigated cropland.

Potential is high for nonirrigated and irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, and cool and warm season vegetables. This soil has medium potential for sugarcane. This soil has low potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, and providing surface drainage are necessary. Cropping systems that include high residue crops help to improve or maintain soil tilth. Land leveling increases the efficiency of irrigation and permits a better distribution of irrigation water. Surface drainage is useful in removing excess water after a heavy rainfall. Subsurface tile drainage lowers the high water table that can develop from irrigation.

Potential is high for nonirrigated and irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Coastal bermudagrass, African stargrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland, although no acreage is used as such. Most of this soil has been cleared and is continuously cropped. A few areas remain undisturbed.

Potential is medium in these areas for wildlife habitat for coyote, weasel, armadillo, white-winged doves, chachalaca, and many migratory birds.

Potential is low for urban and recreation uses. Shrinking and swelling of the soil and the clayey surface layer are the main limitations.

This Olmito soil is in capability subclass IIs, nonirrigated and irrigated; it is in the Clayey Bottomland range site.

45—Pits, borrow. These miscellaneous areas are throughout the county. Areas are long and narrow or square or oblong in shape. Areas range from 5 to 80 acres.

Borrow pits are areas from which soil material was excavated for use as fill for levees and highway overpasses or as foundation material for buildings.

The long and narrow pits are adjacent to the International Boundary and Water Commission levees. These pits are about 3 to 5 feet deep.

The square or oblong pits are mainly within a short distance from expressway overpasses. These pits have vertical walls, are about 6 to 15 feet deep, and usually contain from 6 to 36 inches of water.

46—Pits, caliche. These miscellaneous areas are in the western part of the county and are associated with Cuevitas, Delmita, and Randado soils. Areas are irregular, square, or oblong and range from 5 to 400 acres.

Caliche pits are areas that have been excavated in the mining of caliche. These pits have vertical walls and range from 6 to 25 feet in depth. In some places they are used as sites for sanitary landfills. Some areas are used as drainage outlets and contain 3 to 6 feet of water.

47—Pits, gravel. These miscellaneous areas are in the southwestern part of the county and are associated with the Jimenez and Quemado soils. Areas are irregular, square, or oblong in shape and range from 5 to 350 acres.

Gravel pits are areas that have been excavated for gravel. These pits have vertical walls and range from 10 to 30 feet in depth.

48—Racombes sandy clay loam. This deep, nearly level soil is on plane to concave uplands. Slopes range from 0 to 1 percent. Most areas are small and irregular in shape; some areas are in small, rounded depressions. These areas range from 10 to 50 acres.

Typically, the surface layer is very dark gray sandy clay loam about 13 inches thick. The upper part of the subsoil, from 13 to 25 inches, is dark grayish brown sandy clay loam. The lower part, from 25 to 49 inches, is brown sandy clay loam. The underlying layer extending from 49 to 72 inches is light brown sandy clay loam. The soil is noncalcareous to 37 inches.

This soil is moderately well drained. Surface runoff is slow, and permeability is moderate. The available water capacity is high. This soil is rarely flooded; however, flooding is possible after heavy rainfall for brief periods usually less often than once in 2 years on the average. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thick surface layer because of filling, and in a few areas it has a thin surface layer because of cutting. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Hidalgo, Raymondville, and Willacy soils. Also included are a few areas of Rio soils. The included soils make up less than 20 percent of this map unit.

This Racombes soil is used mostly as irrigated and nonirrigated cropland and for citrus.

Potential is high for nonirrigated and irrigated crops. Although crop yields are high, occasional loss of crops is a risk because of flooding. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. This soil has medium potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, and providing surface drainage are necessary. Cropping systems that include high residue crops help to maintain or improve soil tilth and provide organic matter. Land leveling increases the efficiency of irrigation and permits a better distributin of irrigation water. Surface drainage is useful in removing excess water after a heavy rainfall. Subsurface tile drainage lowers the high water table that can develop from irrigation.

Potential is high for nonirrigated and irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain plant vigor. Coastal bermudagrass, African stargrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland. In rangeland, the dominant grasses in the potential plant community are fourflower trichloris, Arizona cottontop, and sideoats grama in open grassland; woody plants include vine ephedra and spiny hackberry; and forbs include Engelmann-daisy and bundleflower.

With continuous heavy grazing by livestock, fourflower trichloris, Arizona cottontop, and sideoats grama decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, pink pappusgrass, and curly mesquite. If heavy grazing continues for many years, whitebrush, mesquite, pricklypear, and other woody plants form a dense canopy that has an understory of red grama, tumblegrass, and threeawn. Brush encroachment on this soil is a major range management problem.

Potential is high for wildlife habitat including habitat for coyote, weasel, and other furbearing animals. Nesting areas are plentiful for doves, quail, and songbirds.

Potential is low for urban and recreation uses. Shrinking and swelling of the soil, flooding, and the clayey surface layer are the main limitations.

This Racombes soil is in capability subclass IIw, nonirrigated and irrigated; it is in the Clay Loam range site.

49—Racombes sandy clay loam, saline. This deep, nearly level, saline soil is on plane to concave uplands. Slopes range from 0 to 1 percent. Most areas are small, irregular, and slightly depressional. A few areas are small, rounded, and depressional. Some areas are long, narrow drainageways. The areas of this soil range from 10 to 50 acres in size.

Typically, the surface layer is saline, very dark grayish brown sandy clay loam about 19 inches thick. The upper part of the subsoil, from 19 to 36 inches, is saline, dark grayish brown sandy clay loam. The lower part, from 36 to 50 inches, is saline, grayish brown sandy clay loam. The layer below that, from 50 to 62 inches, is saline, pale brown sandy clay loam. The underlying layer extending from 62 to 72 inches is saline, very pale brown sandy clay loam. The soil is noncalcareous to a depth of 50 inches.

This soil is moderately well drained. Surface runoff is slow, and permeability is moderate. The available water capacity is low. This soil is moderately saline to strongly saline as a result of overirrigation and the evaporation of slightly saline water. A water table that is saline is at a depth of 18 to 54 inches. This soil is rarely flooded; however, flooding is possible after heavy rainfall for brief periods usually less than once in 2 years. A few areas of this soil have been altered by land leveling for irrigation. In those areas the surface layer is thick as a result of filling. In a few areas the surface layer is thin as a result of cutting. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of saline Hidalgo and Rio soils. Also included are a few areas of nonsaline Hidalgo, Raymondville, and Rio soils. The included soils make up less than 15 percent of this map unit.

This Racombes soil is used mostly as irrigated cropland or pastureland. A few areas of this soil are idle.

This soil has low potential for nonirrigated and irrigated crops. Because of salinity, careful selection of crops is necessary. The soil is suitable for cotton and grain sorghum. It is not suitable for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, providing surface and subsurface drainage, and adapting cropping systems to the soil limitations are necessary. Cropping systems that include high residue crops help to maintain or improve soil tilth, reduce evaporation, and provide organic matter. Mulches, such as cotton burrs, help reduce evaporation that brings harmful salts to the surface. Land leveling increases the efficiency of irrigation and permits a better distribution of irrigation water. Surface drainage is useful in removing excess water after a heavy rainfall. Subsurface tile drainage lowers the high water table and uniformly leaches the harmful salts.

Potential is low for nonirrigated pasture grasses and medium for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain established plants. Coastal bermudagrass, African stargrass, introduced bluestems, and similar grasses are suited to this soil. Establishing grass is difficult, especially from seed. Subsurface tile drainage helps lower the high water table and remove excess soluble salts.

Potential is low for rangeland. None of this soil is used as rangeland. Potential is low for wildlife habitat including habitat for doves, quail, and furbearing animals.

Potential is low for urban and recreation uses. Wetness, high corrosivity to steel, and the hazard of flooding are the main limitations.

This Racombes soil is in capability subclass IVs, nonirrigated and irrigated. It is not assigned to a range site.

50—Ramadero sandy clay loam. This deep, nearly level soil is on convex uplands. Slopes range from 0 to 1 percent. Most areas are long narrow drainageways. A few areas are small, rounded depressions. The areas range from 5 to 75 acres.

Typically, the surface layer is very dark grayish brown sandy clay loam about 21 inches thick. The next layer, from 21 to 27 inches, is dark grayish brown sandy clay loam. The next layer, from 27 to 39 inches, is brown sandy clay loam. The next layer, from 39 to 53 inches, is pale brown sandy clay loam. The layer extending from 53 to 63 inches is very pale brown sandy clay loam. The soil is noncalcareous to 39 inches.

This soil is moderately well drained. Surface runoff is slow, and permeability is moderate. The available water capacity is high. This soil is occasionally flooded for brief periods after a heavy rainfall usually less than once in 2 years. Some areas of this soil have received 3 to 18 inches of overwash material. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Brennan, Delfina, Hidalgo, McAllen, Randado, and Rio soils. These soils make up less than 25 percent of this map unit.

This Ramadero soil is used mostly as nonirrigated cropland and rangeland.

Potential is high for nonirrigated and irrigated crops. Although crop yields are high, crops are lost occasionally because of flooding. Suitable crops are cotton and grain sorghum.

If this soil is used as cropland, maintaining or improving soil tilth and providing surface drainage are necessary. Cropping systems that include high residue

crops help maintain soil tilth, reduce evaporation, and provide organic matter.

Potential is high for nonirrigated and irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain plant vigor. Coastal bermudagrass, African stargrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland. In open grassland, the dominant grasses in the potential plant community consist of fourflower trichloris, Arizona cottontop, and sideoats grama; woody plants include vine ephedra and spiny hackberry; and forbs include Engelmann-daisy and bushsunflower.

With continuous heavy grazing by livestock, fourflower trichloris, Arizona cottontop, and sideoats grama decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, vine-mesquite, and buffalograss. If heavy grazing continues for many years, mesquite, huisache, pricklypear, and other woody plants form a dense canopy that has an understory of whorled dropseed, tumblegrass, and threeawn. Brush encroachment on this soil is a major range management problem.

Potential is high for wildlife habitat including habitat for deer, javelina, and coyote. Nesting areas are plentiful for white-winged doves, quail, and songbirds.

Potential is low for urban and recreation uses because of the hazard of flooding.

This Ramadero soil is in capability subclass IIw, nonirrigated and irrigated; it is in the Ramadero range site.

51—Randado-Cuevitas complex, 0 to 3 percent slopes. This map unit consists of shallow to very shallow, nearly level or gently sloping soils that are so intricately mixed that separating them was not practical because of the scale selected for mapping. These soils are on convex uplands. Areas are small and irregular in shape and range from 10 to 45 acres.

Randado fine sandy loam makes up about 55 percent of the unit, and Cuevitas fine sandy loam makes up about 25 percent. Other soils make up the rest.

Typically, Randado soil has a surface layer of reddish brown fine sandy loam about 9 inches thick. The subsoil, between depths of 9 and 16 inches, is reddish brown sandy clay loam. Below this layer there is indurated caliche. The soil is noncalcareous above the caliche.

This soil is well drained. Runoff is slow, and permeability is moderate. The available water capacity is very low. When this soil is dry, the surface is hard and crusty. The root zone is shallow. The hazards of water erosion and soil blowing are moderate.

Cuevitas soil has a surface layer of reddish brown fine sandy loam about 8 inches thick. Below the surface layer there is indurated caliche. The soil is noncalcareous down to the caliche.

This soil is well drained. Runoff is medium, and permeability is moderate. The available water capacity is very low. When the soil is dry, the surface is hard and crusty. The root zone is very shallow. The hazards of water erosion and soil blowing are moderate.

Included with this unit in mapping are small areas of Delmita soils and areas of rock outcrop. The included areas make up 20 percent or less of this map unit.

These Randado and Cuevitas soils are used as rangeland. A few areas are idle. The soils are not suited to use as cropland.

Potential for rangeland is low. In rangeland, the dominant grasses in the potential plant community for both Randado and Cuevitas soils are silver bluestem, tanglehead, and Arizona cottontop in open grassland; woody plants include guajillo and kidneywood; and forbs include orange zexmenia and bushsunflower.

With continuous heavy grazing by livestock, silver bluestem, tanglehead, and Arizona cottontop decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, fall witchgrass, and slim tridens. If heavy grazing continues for many years, Texas tridens, red grama, threeawn, blackbrush, leatherstem, and other woody plants dominate the site.

Potential is low for wildlife habitat including habitat for deer, javelina, doves, and quail because of insufficient plant cover.

Potential for urban and recreation uses is low because of rock outcrops and the shallow depth to indurated caliche.

These Randado and Cuevitas soils are in capability subclass VIs, nonirrigated; they are in the Shallow Sandy Loam range site.

52—Raymondville clay loam. This deep, nearly level soil is on plane to slightly concave uplands. Slopes are mainly less than 0.5 percent but range from 0 to 1 percent. Areas are irregular in shape and range from 50 to 950 acres.

Typically, the surface layer is clay loam about 15 inches thick. It is gray in the upper 8 inches and dark gray in the lower 7 inches. The next layer, to a depth of 25 inches, is grayish brown clay loam. The layer below that, to a depth of 43 inches, is grayish brown clay. The next layer, to a depth of 51 inches, is light brownish gray clay. The underlying layer extending to a depth of 65 inches is pale brown clay. The soil is calcareous throughout.

This soil is moderately well drained. Surface runoff is slow. Permeability is slow, and the available water capacity is high. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thick surface layer as a result of filling, and in a few areas it has a thin surface layer as a result of cutting. The root zone is deep but is not easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Hidalgo, Mercedes, Racombes, and saline Raymondville soils. These soils make up less than 15 percent of any mapped area.

This Raymondville soil is used mostly as irrigated and nonirrigated cropland.

This soil has medium potential for nonirrigated crops and high potential for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, and cool and warm season vegetables (fig. 9). Potential is medium for sugarcane. Potential is low for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, and providing surface drainage are necessary. Cropping systems that include high residue crops help to improve or maintain soil tilth. Land leveling increases the efficiency of irrigation and permits better distribution of irrigation water. Surface drainage is useful in removing excess water after a heavy rainfall. Subsurface tile drainage lowers the high water table that can develop from irrigation.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain plant vigor. Coastal bermudagrass, African stargrass, introduced bluestems, and other grasses are suited to this soil.

Potential is medium for rangeland, although no acreage is used as such. Most of this soil has been cleared and is continuously cropped; however, a few areas remain undisturbed. Potential is medium in these areas for wildlife habitat including habitat for white-winged doves, quail, songbirds, and furbearing animals such as coyote and weasel.

Potential is low for urban and recreation uses. Shrinking and swelling of the soil and the clayey surface layer are the main limitations.

This Raymondville soil is in capability subclass IIs, nonirrigated and irrigated; it is in the Clay Loam range site.

53—Raymondville clay loam, saline. This deep, nearly level, saline soil is on plane to slightly concave uplands. Slopes are mainly less than 0.5 percent but range from 0 to 1 percent. Areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is saline, dark gray clay loam about 16 inches thick. The next layer, from 16 to 29 inches, is saline, gray clay loam. The next layer, from 29 to 39 inches, is saline, grayish brown clay. The underlying layer from 39 to 65 inches is saline, very pale brown clay with many soft bodies of calcium carbonate. The soil is calcareous throughout.

Figure 9.—Irrigated carrots on Raymondville clay loam.

This soil is moderately well drained. Surface runoff is slow, and permeability is slow. The available water capacity is low. This soil is moderately saline to strongly saline as a result of overirrigation and the evaporation of slightly saline water. A seasonal water table that is saline is at a depth of 30 to 54 inches. A few areas of this soil have been altered by land leveling for irrigation. In these areas this soil has a thick surface layer because of filling, and in a few areas it has a thin surface layer because of cutting. The rooting zone is deep but is not easily penetrated. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of saline Hidalgo, Mercedes, and Racombes soils. Also included are a few areas of nonsaline Hidalgo, Mercedes, and Racombes soils. The included soils make up less than 15 percent of this map unit.

This Raymondville soil is used mostly as irrigated cropland or pastureland. A few areas are idle.

This soil has low potential for nonirrigated and irrigated crops. Suitable crops are cotton and grain sorghum. This soil is not suitable for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, providing surface and subsurface drainage, and adapting cropping systems to the soil limitations are necessary. Cropping systems that include high residue crops help to improve or maintain soil tilth, reduce evaporation, and provide organic matter. Mulches, such as cotton burrs, help reduce evaporation that brings harmful salts to the surface. Land leveling increases the efficiency of irrigation and permits better distribution of irrigation water. Surface drainage is useful in removing excess water after a heavy rainfall. Subsurface tile drainage lowers the seasonal high water table and provides for uniform leaching of harmful salts.

Potential is low for nonirrigated pasture grasses, and medium for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain established grasses. Coastal bermudagrass, African stargrass, introduced bluestems, and other grasses are suited to this soil. Establishing grass is difficult, especially from seed. Subsurface tile drainage lowers the seasonal high water table and removes excess soluble salts. If pasture is grazed when the surface is wet, this soil puddles.

The potential for rangeland is low, and this soil is not used as rangeland. The potential for habitat for birds and furbearing animals is low because little plant cover is available.

Potential is low for urban and recreation uses. Shrinking and swelling of the soil, the clayey surface layer, wetness, and high corrosivity to uncoated steel are the main limitations.

This Raymondville soil is in capability subclass IVs, nonirrigated and irrigated. It is not assigned to a range site.

54—Raymondville-Urban land complex. This map unit consists of nearly level Raymondville soil and Urban land in areas that are so intricately mixed that to separate them at the scale used for mapping was not practical. Areas are small and irregular in shape and range from 10 to 75 acres. Boundaries commonly coincide with the outer limits of subdivisions, built-up areas, and cities. Slopes are mainly less than 0.5 percent but range from 0 to 1 percent.

Raymondville soil makes up 40 to 80 percent of this map unit, Urban land 15 to 55 percent, and other soils 5 to 10 percent.

Typically, Raymondville soil has a surface layer of gray clay loam about 13 inches thick. The next layer, from 13 to 39 inches, is light brownish gray clay loam. The layer extending from 39 to 65 inches is very pale brown clay loam. The soil is calcareous throughout.

Urban land consists of areas that are covered by single or multiple-unit dwellings, garages, sidewalks, patios, driveways, streets, schools, churches, shopping centers on less than 40 acres, office buildings, paved parking lots, and industrial sites. Some areas of Raymondville soil have been altered by cutting and grading. In other areas, the surface layer is covered with 6 to 24 inches of loamy fill material.

Included in mapping are small areas of Hidalgo, Mercedes, and Racombes soils.

Although the Raymondville soil and Urban land are used for urban structures, their potential for this use is low. The main limitations are high shrink-swell potential, high corrosivity of the soil to uncoated steel, and slow permeability. Shrinking and swelling can cause streets, driveways, sidewalks, patios, ceilings, and buildings to crack and fences to shift. The soil is not suitable for septic tank filter fields. Potential is medium for landscaping and gardening because of the high clay content of this soil and slow permeability.

This map unit is not assigned to a capability subclass or to a range site.

55—Reynosa silty clay loam. This deep, nearly level soil is in areas of ancient stream terraces. Slopes range from 0 to 1 percent. Areas are irregular in shape and range from 20 to 100 acres.

Typically, the surface layer is grayish brown silty clay loam about 15 inches thick. The next layer, from 15 to 48 inches, is light brownish gray silty clay loam. The layer extending from 48 to 65 inches is pale brown silt loam. The soil is calcareous throughout.

This soil is well drained. Surface runoff is slow, and permeability is moderate. The available water capacity is high. A few areas of this soil have been altered by land leveling for irrigation. In these areas this soil has a thin surface layer because of cutting, in a few areas it has a thick surface layer because of filling, and in some areas all of the surface layer has been removed. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Cameron, Runn, and Harlingen soils. Also included are a few small areas of saline Reynosa soils. The included soils make up less than 15 percent of this map unit.

This Reynosa soil is used almost entirely as irrigated cropland.

Potential is medium for nonirrigated crops and high for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. This soil has high potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, and providing surface drainage are necessary. Cropping systems that include high residue crops help to maintain or improve soil tilth and provide organic matter. Land leveling reduces runoff, and permits better distribution of irrigation water. Surface drainage is useful in removing excess water after a heavy rainfall. Subsurface tile drainage lowers the high water table that can develop from irrigation. The high lime content of this soil can cause chlorosis in some plants, especially in areas where the surface layer has been removed by land leveling. Applying mulch or manure helps to offset the loss of organic matter from land leveling.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Coastal bermudagrass, African stargrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland, although no acreage is used as such. Most of this soil has been cleared and is continuously cropped; however, a few areas remain undisturbed. Potential is medium in these areas for habitat for armadillo and coyote, weasel, and other furbearing animals. Nesting areas are plentiful for white-winged doves, chachalaca, songbirds, and many migratory birds.

Potential is medium for urban uses and high for recreation uses. Shrinking and swelling of the soil and high corrosivity to uncoated steel are the main limitations.

This Reynosa soil is in capability subclass IIIc, nonirrigated and in class I, irrigated; it is in the Loamy Bottomland range site.

56—Reynosa silty clay loam, saline. This deep, nearly level saline soil is in areas of ancient stream terraces. Slope range from 0 to 1 percent. Areas are irregular in shape and range from 10 to 75 acres.

Typically, the surface layer is saline, grayish brown silty clay loam about 12 inches thick. The next layer, from 12 to 37 inches, is saline, light brownish gray silty clay loam. The layer extending from 37 to 65 inches is saline, light gray silty clay loam. The soil is calcareous throughout.

This soil is well drained. Surface runoff is slow, and permeability is moderate. Available water capacity is low. This soil is moderately saline to strongly saline as a result of overirrigation and evaporation of slightly saline water. A seasonal water table that is saline is at a depth of 18 to 54 inches. A few areas of this soil have been altered by land leveling for irrigation. In those areas the soil has a thin surface layer because of cutting. In a few areas, it has a thick surface layer because of filling, and in some areas all of the surface layer has been removed. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of saline Runn soils. Also included are a few small areas of nonsaline Reynosa and Runn soils. The included soils make up less than 15 percent of this map unit.

This Reynosa soil is used mostly as irrigated cropland or pastureland. A few areas are idle.

This soil has low potential for nonirrigated and irrigated crops. Suitable crops are cotton and grain sorghum. This soil is not suitable for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, providing surface and subsurface drainage, and adapting cropping systems to the soil limitations are necessary. Cropping systems that include high residue crops help to maintain or improve soil tilth, reduce evaporation, and provide organic matter. Mulches, such as cotton burrs, help reduce evaporation which brings harmful salts to the surface. Land leveling reduces runoff and permits a better distribution of irrigation water. Surface drainage is useful in removing excess water after a heavy rainfall. Subsurface tile drainage lowers the seasonal high water table and provides for uniform leaching of harmful salts. The high lime content of this soil can cause chlorosis in some plants, especially in areas where the surface layer has been removed by land leveling operations. Applying mulch or manure helps to offset the loss of organic matter from land leveling.

Potential is low for nonirrigated pasture grasses and medium for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain established grasses. Coastal bermudagrass, African stargrass, introduced bluestems, and similar grasses are suited to this soil. Establishing grass is difficult, especially from seed. Subsurface tile drainage lowers the high water table and helps to remove excess soluble salts.

Potential is low for rangeland. None of this soil is in rangeland. Potential is low for wildlife habitat including habitat for birds and furbearing animals because little plant cover or food is available.

Potential is low for urban and recreation uses. Wetness, the high corrosivity to steel, and a clayey surface layer are the main limitations.

This Reynosa soil is in capability subclass IVs, nonirrigated and irrigated. It is not assigned to a range site.

57—Reynosa-Urban land complex. This map unit consists of nearly level Reynosa soil and Urban land in areas so intricately mixed that separating them was not practical because of the scale selected for mapping. Areas are small and irregular in shape and range from 10 to 75 acres. Boundaries commonly coincide with the outer limits of subdivisions, built-up areas, and cities. Slopes are mainly less than 0.5 percent but range from 0 to 1 percent.

Reynosa soil makes up 35 to 80 percent of this unit, Urban land 15 to 55 percent, and other soils 5 to 10 percent.

Typically, the surface layer of the Reynosa soil is brown silty clay loam about 10 inches thick. The next layer, from 10 to 40 inches, is pale brown silty clay loam. The underlying layer extending from 40 to 65 inches is very pale brown silty clay loam. The soil is calcareous throughout.

Urban land consists of areas that are covered by single or multiple-unit dwellings, garages, sidewalks, patios, driveways, streets, schools, churches, shopping centers on less than 40 acres, office buildings, paved parking lots, and industrial sites. Some areas of Reynosa soil have been altered by cutting and grading. In some areas the surface layer is covered with 6 to 24 inches of material.

Included in mapping are a few small areas of Runn and Harlingen soils.

Although the Reynosa soil and Urban land are used for urban structures, their potential for this use is moderate. The main limitations are moderate shrink-swell potential and the high corrosivity of the soil to uncoated steel. Potential is high for landscaping and gradening. Most flowers, shrubs, and trees grown in the county are well suited to this soil. However, the high lime content of this soil can cause chlorosis in some plants, for example, avocados and citrus. Iron sulfate or iron chelates can be added to correct this condition.

These soils are not assigned to a capability subclass or to a range site.

58—Rio fine sandy loam. This deep, nearly level soil is on concave uplands. Slopes are mostly less than 0.5 percent but range from 0 to 1 percent. Areas are small, round, and depressional and range from 5 to 100 acres.

Typically, the surface layer is dark gray fine sandy loam about 19 inches thick. The next layer, from 19 to 24 inches, is dark gray sandy clay loam that has yellowish red mottles. The next layer, from 24 to 38 inches, is gray sandy clay that has yellowish red mottles. The next layer, from 38 to 65 inches, is grayish brown sandy clay loam that has a few strong brown mottles. The underlying layer extending from 65 to 72 inches is light gray sandy clay loam. The soil is noncalcareous to 38 inches.

This soil is somewhat poorly drained. Runoff from surrounding soils causes ponding at times. Permeability is slow, and the available water capacity is high. A high water table occurs at a depth of 0 to 6 feet. Sometimes the soil has ponded water as much as 2 feet deep. This soil is frequently flooded for long periods after a heavy rainfall, usually more often than once in 2 years. A few areas of this soil have been altered by land leveling for irrigation. The altered areas have a thick surface layer because of filling by the land leveling process. The rooting zone is deep but is hard for plant roots to penetrate. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are small areas of Racombes, Ramadero, and soils similar to this Rio soil except that they have a surface layer of clay loam. The included soils make up less than 15 percent of this map unit.

This Rio soil is used mostly as nonirrigated and irrigated cropland, pastureland, and rangeland.

This soil has medium potential for nonirrigated and irrigated crops. Suitable crops are cotton and grain sorghum, but loss of the crop is a risk because of ponding. This soil is not suitable for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, and providing surface drainage are necessary. Cropping systems that include high residue crops help improve soil tilth. Because of ponding, surface drainage is needed to remove excess water after a heavy rainfall. Subsurface tile drainage lowers the seasonal high water table.

Potential is medium for nonirrigated and irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Surface drainage is necessary in most areas. Improved bermudagrass, African stargrass, and similar grasses are suited to this soil.

Potential is medium for rangeland. The dominant grasses in the potential plant community are fourflower trichloris, Arizona cottontop, and vine-mesquite in open grassland. The woody plants include vine ephedra and spiny hackberry; and forbs include Engelmann-daisy and bundleflower.

With continuous heavy grazing by livestock, fourflower trichloris, Arizona cottontop, and vine-mesquite decrease in the plant community. These plants are replaced by the less desirable pink pappusgrass, curly mesquite, and pinhole bluestem. If heavy grazing continues for many years, huisache, retama, blackbrush, and other woody plants form a dense canopy that has an understory of red grama, threeawn, and ragweed.

Potential is medium for wildlife habitat including habitat for deer, javelina, doves, quail, and songbirds.

Potential is low for urban and recreation uses because of the hazards of ponding and wetness.

This soil is in capability subclass IIIw, nonirrigated and irrigated; it is in the Clay Loam range site.

59—Rio fine sandy loam, saline. This deep, nearly level, saline soil is on concave uplands. Slopes are

mostly less than 0.5 percent but range from 0 to 1 percent. Areas are in long, narrow drainageways or in small, round depressions and range from 5 to 75 acres.

Typically, the surface layer is saline, dark grayish brown fine sandy loam about 19 inches thick. The next layer, from 19 to 36 inches is saline, grayish brown clay loam that has yellowish red mottles. The next layer, from 36 to 49 inches, is saline, grayish brown sandy clay that has yellowish red mottles. The underlying layer extending from 49 to 65 inches is saline, very pale brown sandy clay loam. The soil is noncalcareous to 49 inches.

This soil is somewhat poorly drained. Runoff from surrounding soils ponds on the surface. Permeability is slow. The available water capacity is low. This soil is moderately saline to strongly saline as a result of overirrigation and evaporation of slightly saline water or from seepage. A seasonal high water table that is saline is at a depth of 0 to 4 1/2 feet and in some places causes ponding. Also, this soil is frequently ponded for long periods after a heavy rainfall, usually more often than once in 2 years. A few areas of this soil have been altered by land leveling for irrigation. In these areas, the surface layer is thick as a result of filling. The root zone is deep, but the soil is not easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are small areas of saline Racombes soils. Also included are a few areas of nonsaline Rio and Racombes soils. The included soils make up less than 15 percent of this map unit.

This Rio soil is mostly idle. A few areas are used as irrigated cropland.

This soil has low potential for nonirrigated and irrigated crops. Suitable crops are cotton and grain sorghum. Flooding can cause crop loss. This soil is not suitable for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, providing surface and subsurface drainage, and adapting cropping systems to the soil limitations are necessary. Cropping systems that include high residue crops help maintain or improve soil tilth, reduce evaporation, and provide organic matter. Mulches, such as cotton burrs, help reduce evaporation that brings harmful salts to the surface. Land leveling increases the efficiency of irrigation and permits better distribution of irrigation water. Surface drainage is useful in removing excess water after heavy rainfall. Subsurface tile drainage lowers the seasonal high water table and provides for uniform leaching of harmful salts.

Potential is low for nonirrigated pasture grasses and medium for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain established grasses. Coastal bermudagrass, African stargrass, introduced bluestem, and similar grasses are suited to this soil. Establishing grass is difficult, especially from seed. Subsurface tile drainage lowers the seasonal water table and helps remove excess soluble salts.

Potential is low for rangeland. The dominant grasses in the potential plant community are gulf cordgrass, alkali sacaton, and switchgrass in open grassland; the woody plants include spiny aster and pricklypear; and forbs include pickleweed. Variations in salinity cause local variations in the plant community.

With continuous heavy grazing by livestock, gulf cordgrass, alkali sacaton, and switchgrass decrease in the plant community. These plants are replaced by the less desirable whorled dropseed, buffalograss, and knotroot bristlegrass. If heavy grazing continues for many years, glasswort and pickleweed dominate the site.

Potential is low for habitat for deer, quail, and doves because little plant cover is available.

Potential is low for urban and recreation uses. The main limitations are ponding, wetness, excess salts, and high corrosivity to steel.

This soil is in capability subclass IVs, nonirrigated and irrigated; it is in the Salty Prairie range site.

60—Rio clay loam. This deep, nearly level soil is on concave uplands. Slopes are mostly 0.5 percent but range from 0 to 1 percent. Areas are small, round, and concave and range from 3 to 10 acres.

Typically, the surface layer is dark gray clay loam about 12 inches thick. The upper part of the subsoil, from 12 to 18 inches, is dark gray clay that has reddish brown and strong brown mottles. The lower part, from 18 to 38 inches, is gray clay that has brownish yellow and strong brown mottles. The next layer, from 38 to 58 inches, is grayish brown clay loam that has few strong brown mottles. The layer extending from 58 to 65 inches is light brownish gray clay loam. The soil is noncalcareous to 38 inches.

This soil is somewhat poorly drained. Runoff from surrounding soils ponds on the surface. Permeability is slow, and the available water capacity is high. A seasonal high water table is at a depth of 0 to 6 feet. In some places ponded water at times is as much as 2 feet deep. This soil is frequently ponded for long periods after a heavy rainfall, usually more often than once in 2 years. A few areas of this soil have been altered by land leveling for irrigation. In these areas, the surface layer is thick as a result of filling. The root zone is deep, but the soil is not easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Racombes, Ramadero, and Tiocano soils. Also included are a few small areas of soils that have a loamy subsoil. The included soils make up less than 13 percent of this map unit.

This Rio soil is used mostly as irrigated and nonirrigated cropland, pastureland, and rangeland.

This soil has medium potential for nonirrigated and irrigated crops. Suitable crops are cotton and grain sorghum, but loss of crops is a risk because of flooding. This soil is not suitable for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, and providing surface drainage are necessary. Cropping systems that include high residue crops help to improve soil tilth. Because of ponding, surface drainage is needed to remove excess water after a heavy rainfall. Subsurface tile drainage lowers the seasonal high water table.

Potential is medium for pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. These soils puddle if grazing is permitted when the surface is wet. Surface drainage is necessary in most areas. Improved bermudagrass, African stargrass, and similar grasses are suited to this soil.

Potential is medium for rangeland. The dominant grasses in the potential plant community are fourflower trichloris, Arizona cottontop, and vine-mesquite in open grassland; the woody plants include vine ephedra and spiny hackberry; and forbs include Engelmann-daisy and bundleflower.

With continuous heavy grazing by livestock, fourflower trichloris, Arizona cottontop, and vine-mesquite decrease in the plant community. These plants are replaced by the less desirable pink pappusgrass, curly mesquite, and pinhole bluestem. If heavy grazing continues for many years, huisache, retama, blackbrush, and other woody plants form a dense canopy that has an understory of red grama, threeawn, and ragweed.

Potential is medium for habitat for deer, javelina, doves, quail, and songbirds.

Potential is low for urban and recreation uses. Flooding and the clay loam surface layer are the main limitations.

This Rio soil is in capability subclass IIIw, nonirrigated and irrigated; it is in the Clay Loam range site.

61—Rio clay loam, saline. This deep, nearly level, saline soil is on concave uplands. Slopes are mostly less than 0.5 percent but range from 0 to 1 percent. Areas are small, round, and depressional and range from 3 to 25 acres.

Typically, the surface layer is saline, gray clay loam about 12 inches thick. The next layer, from 12 to 24 inches, is saline, gray sandy clay that has reddish brown and strong brown mottles. The next layer, from 24 to 36 inches, is saline, gray clay loam that has reddish brown and strong brown mottles. The next layer, from 35 to 55 inches, is saline, gray clay loam that has a few light brownish gray mottles. The layer extending from 55 to 65 inches is saline, light brownish gray clay loam. The soil is noncalcareous to 36 inches.

This soil is somewhat poorly drained. Runoff from surrounding soils ponds on the surface. Permeability is slow, and the available water capacity is low. This soil is moderately to strongly saline as a result of overirrigation and evaporation of slightly saline water or from seepage. A seasonal water table that is saline is at a depth of 0 to 54 inches. In places, ponded water is as much as 2 feet deep. This soil is frequently ponded for long periods after a heavy rainfall, usually more often than once in 2 years. A few areas of this soil have been altered by land leveling for irrigation. In these areas, the surface layer is thick as a result of filling. The root zone is deep, but the soil is not easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Racombes, Ramadero, Tiocano, and saline Racombes soils. Also included are a few areas of soils that have a loamy subsoil. The included soils make up less than 15 percent of this map unit.

This Rio soil is used mostly as irrigated cropland or pastureland. A few areas are idle.

This soil has a low potential for nonirrigated and irrigated crops, but loss of crops is a risk because of ponding. This soil is not suitable for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, providing surface and subsurface drainage, and adapting cropping systems to the soil limitations are necessary. Cropping systems that include high residue crops help to improve or maintain soil tilth, reduce evaporation, and provide organic matter. Because of ponding, surface drainage is needed to remove excess water after a heavy rainfall. Subsurface tile drainage lowers the seasonal high water table and provides uniform leaching of harmful salts.

Potential is low for nonirrigated pasture grasses and medium for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain established grasses. Surface drainage is necessary in most areas. Improved bermudagrass, African stargrass, and similar grasses are suited to this soil. Establishing grass is difficult, especially from seed. Subsurface tile drainage lowers the seasonal high water table and removes excess soluble salts. If pasture is grazed when the surface is wet, this soil puddles.

Potential is low for rangeland. The dominant grasses in the potential plant community are gulf cordgrass, alkali sacaton, and switchgrass in open grassland; the woody plants include spiny aster and pricklypear; and forbs include pickleweed. Variations in salinity cause local variations in the plant community.

With continuous heavy grazing by livestock, gulf cordgrass, alkali sacaton, and switchgrass decrease in the plant community. These plants are replaced by whorled dropseed, buffalograss, and knotroot bristlegrass. If heavy grazing continues for many years, glasswort and pickleweed dominate the site.

Potential is low for habitat for deer, quail, and doves because little plant cover and food is available.

Potential is low for urban and recreation uses. Ponding, a clay loam surface layer, and high corrosivity to uncoated steel are the main limitations.

This Rio soil is in capability subclass IVs, nonirrigated and irrigated; it is in the Salty Prairie range site.

62—Rio Grande silt loam. This deep, nearly level soil is on the active flood plain of the Rio Grande. Slopes range from 0 to 1 percent. Areas are irregular in shape and range from 20 to 50 acres.

Typically, the surface layer is light brownish gray silt loam about 8 inches thick. The next layer, from 8 to 49 inches, is pale brown silt loam. The next layer, from 49 to 57 inches, is grayish brown silty clay loam. The layer extending from 57 to 65 inches, is very pale brown silt loam. Thin strata of contrasting textures occur throughout the soil. The soil is calcareous throughout.

This soil is well drained. Surface runoff is slow. Permeability is moderately rapid. The available water capacity is high. This soil is rarely flooded; however, flooding is possible during tropical storms for brief periods. A few areas of this soil have been altered by land leveling for irrigation. In these areas, the surface layer is thin as a result of cutting. In a few areas the surface layer is thick as a result of filling. The root zone is deep, and the soil is easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are long narrow streaks and round patches of Camargo and Rio Grande soils that have a clay loam surface layer. Also included are a few small areas of Matamoros soils in depressions and small streaks of Zalla soils. The included soils make up less than 15 percent of this map unit.

This Rio Grande soil is used almost entirely as irrigated cropland.

Potential is medium for nonirrigated crops and high for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. Potential is low for citrus because of the hazard of flooding.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, and conserving soil moisture are necessary. Cropping systems that include high residue crops help to improve or maintain soil tilth, reduce evaporation, provide organic matter, and control soil blowing. Because of the strata of contrasting textures throughout the soil, a perched water table is common for a few days after heavy irrigation or rainfall. Land leveling helps control erosion and runoff and permits better distribution of irrigation water. Because of the contrasting textures below the surface layer, land-leveling cuts should be made carefully because such undesirable material as sand can be exposed in places. The high lime content of this soil can cause chlorosis in some plants. Temporary field ditches are difficult to maintain, and the length of irrigation runs should be shorter than on soils that have a silty clay loam surface layer.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain pasture plants. Coastal bermudagrass, African stargrass, and similar grasses are suited to this soil.

Potential is high for rangeland, although no acreage is used as such. Most of this soil has been cleared and is continuously cropped; however, a few areas remain undisturbed.

The potential is high for habitat for coyote, weasel, and armadillo. Nesting areas are good for white-winged doves, chachalaca, songbirds, and many migratory birds.

Potential is low for urban and recreation uses because of the hazard of flooding.

This Rio Grande soil is in capability subclass IIIc, nonirrigated and in class I, irrigated; it is in the Loamy Bottomland range site.

63—Rio Grande silty clay loam. This deep, nearly level soil is on the active flood plain of the Rio Grande. Slopes are mainly less than 0.5 percent but range from 0 to 1 percent. Areas are irregular in shape and range from 5 to 45 acres.

Typically, the surface layer is grayish brown silty clay loam about 7 inches thick. The next layer, from 7 to 15 inches, is grayish brown silty clay loam. The next layer, from 15 to 43 inches, is pale brown silt loam. The layer extending from 43 to 65 inches is light brownish gray silty clay loam. Thin strata of contrasting textures occur throughout the soil. The soil is calcareous throughout.

This soil is well drained. Surface runoff is slow. Permeability is moderately rapid. The available water capacity is high. This soil is rarely flooded; however, flooding is possible during tropical storms for brief periods. A few areas of this soil have been altered by land leveling for irrigation. In these areas the surface layer is thick as a result of filling, and in a few areas the surface layer is thin as a result of cutting. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Camargo soils and Rio Grande soils that have a silt loam surface layer. Also included are a few small areas of Matamoros soils in depressions. The included soils make up less than 15 percent of this map unit.

This Rio Grande soil is used almost entirely as irrigated cropland.

Potential is medium for nonirrigated crops and high for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. Potential is low for citrus because of the hazard of flooding.

On cropland, maintaining or improving soil tilth, managing irrigation water, and conserving soil moisture are necessary. Cropping systems that include high residue crops are needed to improve or maintain soil tilth and provide organic matter. Because of the strata of contrasting textures throughout the soil, a perched water table is common for a few days after heavy irrigation or rainfall. Land leveling reduces runoff and permits a better

distribution of irrigation water. Because of the contrasting textures below the surface layer, land-leveling cuts should be made carefully because such material as sand can be exposed in places. The high lime content of this soil can cause chlorosis in some plants.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain pasture grasses. Coastal bermudagrass, African stargrass, and similar grasses are suited to this soil.

Potential is high for rangeland, although no acreage is used as such. Most of this soil has been cleared and is continuously cultivated; however, a few areas remain undisturbed. Potential is high in these areas for habitat for coyote, weasel, and armadillo. Nesting areas are good for white-winged doves, chachalaca, songbirds, and many migratory birds.

Potential is low for urban and recreation uses because of the hazard of flooding.

This Rio Grande soil is in capability subclass IIIc, nonirrigated and in class I, irrigated; it is in the Loamy Bottomland range site.

64—Runn silty clay. This deep, nearly level soil is in areas of ancient stream terraces. Slopes are mainly less than 0.5 percent but range from 0 to 1 percent. Areas are broad and irregular in shape and range from 10 to 250 acres.

Typically, the surface layer is dark grayish brown silty clay about 18 inches thick. The next layer, from 18 to 38 inches, is light brownish gray silty clay. The next layer, from 38 to 55 inches, is pale brown silty clay. The layer extending from 55 to 65 inches is pale brown silty clay loam. The soil is calcareous throughout.

This soil is moderately well drained. Surface runoff is slow. Permeability is slow, and the available water capacity is high. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thick surface layer because of filling, and in a few areas it has a thin surface layer because of cutting. The rooting zone is deep but is not easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of Harlingen, Reynosa, and saline Runn soils. The included soils make up less than 15 percent of this map unit.

This Runn soil is used almost entirely as irrigated cropland.

Potential is high for nonirrigated crops and high for irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, and cool and warm season vegetables. This soil has medium potential for sugarcane. This soil has low potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, and providing surface drainage are necessary. Cropping systems that include high residue crops help to improve or maintain soil tilth. Land leveling increases the efficiency of irrigation and permits better distribution of irrigation water. Surface drainage is useful in removing excess water after a heavy rainfall. Subsurface tile drainage lowers the high water table that can develop from irrigation.

Potential is medium for nonirrigated pasture grasses and high for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain plants. Coastal bermudagrass, African stargrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland, although no acreage is used as such. Most of this soil has been cleared and is continuously cropped; a few areas remain undisturbed. Potential is medium in these areas for habitat for coyote, weasel, armadillo, white-winged doves, chachalaca, songbirds, and many migratory birds.

Potential is low for urban and recreation uses. Shrinking and swelling of the soil and the clayey surface layer are the main limitations.

This Runn soil is in capability subclass IIs, nonirrigated and irrigated; it is in the Clayey Bottomland range site.

65—Runn silty clay, saline. This deep, nearly level saline soil is in areas of ancient stream terraces. Slopes are mainly less than 0.5 percent but range from 0 to 1 percent. Areas are broad and irregular in shape and range from 10 to 150 acres.

Typically, the surface layer is saline, grayish brown silty clay about 16 inches thick. The next layer, from 16 to 54 inches, is saline, brown silty clay. The layer extending from 54 to 65 inches is saline, light brown silty clay. The soil is calcareous throughout.

This soil is moderately well drained. Surface runoff is slow. Permeability is slow, and the available water capacity is low. This soil is moderately saline to strongly saline as a result of overirrigation and evaporation of slightly saline water. A seasonal high water table that is saline is at a depth of 2 1/2 to 5 feet. A few areas of this soil have been altered by land leveling for irrigation. In these areas this soil has a thick surface layer because of filling; in a few areas it has a thin surface layer because of cutting. The root zone is deep but is not easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included with this soil in mapping are small areas of saline Harlingen and Reynosa soils. Also included are small areas of nonsaline Harlingen, Reynosa, and Runn soils. The included soils make up less than 15 percent of this map unit.

This Runn soil is used almost entirely as irrigated cropland or pastureland. A few areas are idle.

This soil has low potential for nonirrigated and irrigated crops. Suitable crops are cotton and grain sorghum. This soil is not suitable for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, providing

surface and subsurface drainage, and adapting cropping systems to the soil limitations are necessary. Cropping systems that include high residue crops help to improve or maintain soil tilth, reduce evaporation, and provide organic matter. Mulches, such as cotton burrs, help reduce evaporation that brings harmful salts to the surface. Land leveling increases the efficiency of irrigation and permits better distribution of irrigation water. Surface drainage removes excess water after a heavy rainfall. Subsurface tile drainage lowers the seasonal high water table and provides uniform leaching of harmful salts.

Potential is low for nonirrigated pasture grasses and medium for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain established grasses. Coastal bermudagrass, African stargrass, introduced bluestems, and similar grasses are suited to this soil. Establishing grass is difficult, especially from seed. Subsurface tile drainage helps lower the seasonal high water table and remove excess soluble salts. If pasture is grazed when the surface is wet, this soil puddles.

Potential is low for rangeland. This soil is not used as rangeland. Potential is low for habitat for doves, quail, and furbearing animals because little plant cover or food is available.

Potential is low for urban and recreation uses. Shrinking and swelling of the soil, the clayey surface layer, wetness, and corrosivity to uncoated steel are the main limitations.

This Runn soil is in capability subclass IVs, nonirrigated and irrigated. It is not assigned to a range site.

66—Sarita fine sand, 0 to 3 percent slopes. This deep, nearly level to gently sloping soil is on convex uplands. These areas are small and irregular in shape. These areas range from 25 to 100 acres.

Typically, the surface layer is light brownish gray fine sand about 8 inches thick. The next layer, from 8 to 48 inches, is very pale brown fine sand. The next layer, from 48 to 52 inches, is pale brown fine sandy loam that has yellowish brown mottles. The next layer, from 52 to 58 inches, is pale brown sandy clay loam that has brown and red mottles. The underlying layer extending from 58 to 80 inches is light yellowish brown sandy clay loam. The soil is noncalcareous throughout.

This soil is well drained. Surface runoff is very slow, and permeability is moderately rapid. Available water capacity is low. This soil is saturated to a depth of 48 inches after heavy rainfall for short periods during the fall and spring. The root zone is deep and is easily penetrated by plant roots. Water erosion is a moderate hazard, and soil blowing is a severe hazard.

Included with this soil in mapping are a few areas of Falfurrias, Nueces, and Comitas soils. The included soils make up less than 25 percent of this map unit.

This Sarita soil is used mainly as rangeland. A few areas are used as nonirrigated and sprinkler irrigated cropland.

Potential is low for nonirrigated and irrigated crops. Because of the thick sandy surface layer, careful selection of crops is necessary. Suitable crops are watermelons and peanuts.

If this soil is used as cropland, maintaining or improving soil tilth, conserving soil moisture, and controlling soil blowing are necessary. Cropping systems that include high residue crops help to maintain soil tilth, reduce evaporation, and provide organic matter to control soil blowing. This soil is droughty because of the thick sandy surface layer. Stripcropping helps control soil blowing.

Potential is low for nonirrigated pasture grasses and medium for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain established grasses. Improved bermudagrass and weeping lovegrass are suited to this soil. Loose sandy seedbeds and the cutting action of blowing sand from the surface layer make establishing grass difficult.

Potential is medium for rangeland. The dominant grasses in the potential plant community are seacoast bluestem, brownseed paspalum, and indiangrass in open grassland; the woody plants include mesquite and pricklypear; and forbs include bundleflower and sensitivebrier.

With continuous heavy grazing pressure by livestock, seacoast bluestem, brownseed paspalum, and indiangrass decrease in the plant community. These plants are replaced by the less desirable fringeleaf paspalum, gulfdune paspalum, and balsamscale. If heavy grazing continues for many years, red lovegrass, threeawn, and crotons will dominate the site. Woody plants increase only slightly.

Potential is medium for habitat for deer, javelina, doves, and quail because of insufficient plant cover and food.

Potential is low for urban and recreation uses because of the sandy surface layer.

This Sarita soil is in capability subclass IVe, nonirrigated, and in IIIe, irrigated; it is in the Sandy range site.

67—Tiocano clay. This deep, nearly level soil is on concave uplands. Slopes are mostly less than 0.5 percent but range from 0 to 1 percent. Areas are small, round, and concave and range from 3 to 30 acres.

Typically, the surface layer is dark gray clay about 38 inches thick. The next layer, from 38 to 52 inches, is gray clay. The layer extending from 52 to 63 inches is light brownish gray clay. The soil is noncalcareous to 38 inches.

This soil is somewhat poorly drained. The surface ponds from runoff from surrounding soils. Permeability is very slow. The available water capacity is high. In most

years this soil is saturated or covered with water during the growing season. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thick surface layer from fill material. The root zone is deep but is not easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small areas of Rio, Ramadero, and Racombes soils. Also included are a few areas that have sandy overwash material from 3 to 10 inches thick on the surface. The included soils make up less than 15 percent of this map unit.

This Tiocano soil is idle or is used as pastureland, rangeland, or wetland wildlife habitat. This soil is not suitable for use as cropland.

Potential is medium for pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed on this soil. If the pasture is grazed when the surface is wet, this soil puddles. Surface drainage is needed to remove surface water after a heavy rainfall.

Potential is low for rangeland. In open grassland, the dominant grasses in the potential plant community consist of Hartweg paspalum, white tridens, and switchgrass; woody plants include sesbania; and there are a few annual forbs.

With continuous heavy grazing by livestock, Hartweg paspalum, white tridens, and switchgrass decrease in the plant community. These are replaced by the less desirable spike lovegrass, knotroot bristlegrass, and curlymesquite. If heavy grazing continues for many years huisache, retama, and sesbania form a dense canopy that has an understory of common bermudagrass, annual forbs, rushes, and sedges.

The potential is low for wildlife habitat including habitat for deer, javelina, doves, and quail; however, the potential is high for habitat for wetland wildlife including ducks, rails, herons, and muskrats.

Potential is low for urban and recreation uses. Ponding, shrinking and swelling of the soil, and the clayey surface layer are main limitations.

This Tiocano soil is in capability subclass VIw, nonirrigated; and is in the Lakebed range site.

68—Urban land. This map unit is mainly in the business sections of the cities of Alamo, Donna, Edinburg, Pharr, McAllen, Mercedes, Mission, and Weslaco.

The unit is made up of extensively built-up areas that are 85 to 100 percent covered by streets, parking lots, buildings, and other structures. The open areas consist mainly of soils that have been disturbed by cutting or grading or are covered with fill material.

Included in mapping are small areas of moderately built-up areas where buildings and other structures cover only 45 to 70 percent of the surface. The included areas make up as much as 25 percent of Urban land.

This unit is not assigned to a capability subclass or to a range site.

69—Ustorthents, loamy. These deep, nearly level soils are on uplands. Slopes are mostly less than 0.5 percent but range from 0 to 1 percent. Areas are irregular in shape and range from 10 to 50 acres.

This map unit consists of soils that have been drastically modified by land leveling for irrigation. About 24 to 60 inches of the original soil has been removed by mechanical means. The modified soils include Delfina, Hidalgo, Hargill, and Willacy soils. Ustorthents, loamy, are firm, mildly alkaline or moderately alkaline, brown, light brown, very pale brown, reddish brown, yellowish red, or pink sandy clay loam or clay loam. In some areas about 6 inches of the original surface layer has been returned as backfill.

These soils are well drained. Surface runoff is slow, and permeability is moderate. The available water capacity is medium. The soils are very low in organic matter and fertility. Because of the high calcium carbonate content, iron chlorosis is a severe problem for plants. The root zone is deep. The hazards of water erosion and soil blowing are slight.

Included in mapping are small areas of Delfina, Hargill, Hidalgo, and Willacy soils. These soils make up less than 15 percent of this map unit.

The soils making up this map unit are used as irrigated cropland, although their potential for this use is low. The best suited crop is cotton, although other crops such as grain sorghum, sugarcane, and cool and warm season vegetables are grown. If these soils are used as cropland, maintaining or improving soil tilth, reducing iron chlorosis, managing irrigation water, and providing surface drainage are necessary. Cropping systems that include high residue crops help to improve soil tilth and provide organic matter. Surface drainage is useful in removing excess water after a heavy rainfall. Subsurface tile drainage lowers the high water table that can develop from irrigation. A well balanced fertilizer program is needed. Applying mulch or manure is needed to help offset the loss of organic matter in the surface and subsurface layers.

These soils are not in rangeland. Potential for wildlife habitat is low because these soils are continuously cropped or fallowed.

Potential is medium for urban and recreation uses. Shrinking and swelling of the soil and high corrosivity of the soil to uncoated steel are the main limitations.

Ustorthents, loamy, are in capability subclass IIIs, irrigated. They are not assigned to a range site.

70—Willacy fine sandy loam, 0 to 1 percent slopes. This deep, nearly level soil is on convex uplands. These areas are irregular in shape and range from 25 to 200 acres.

Typically, the surface layer is dark grayish brown fine sandy loam about 14 inches thick. The upper part of the subsoil, from 14 to 19 inches, is dark grayish brown sandy clay loam. The lower part, from 19 to 59 inches, is brown sandy clay loam. The next layer, from 59 to 69

inches, is pale brown sandy clay loam. The layer extending from 69 to 80 inches is very pale brown sandy clay loam. The soil is noncalcareous to 42 inches.

This soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is high. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thin surface layer because of cutting, in a few areas it has a thick surface layer because of filling, and in some areas all of the surface layer has been removed. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is slight, and the hazard of soil blowing is moderate.

Included with this soil in mapping are small areas of Hargill, Hidalgo, Delfina, and Racombes soils. Also included are a few areas of a soil that has secondary lime within a depth of 36 inches. The included soils make up less than 25 percent of this map unit.

This Willacy soil is used mostly as irrigated and nonirrigated cropland and for citrus.

This soil has high potential for nonirrigated and irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. This soil has high potential for citrus (fig. 10).

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, and conserving soil moisture are necessary. Cropping systems that include high residue crops help to maintain soil tilth, reduce evaporation, provide organic matter, and control soil blowing. Land leveling reduces erosion and runoff and permits better distribution of irrigation water. Subsurface tile drainage lowers the high water table that can develop from irrigation. Temporary field ditches are difficult to maintain.

Potential is high for nonirrigated and irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain vigorous plants. Improved bermudagrass, buffelgrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland. In open grassland, the dominant grasses in the potential plant community consist of twoflower trichloris, fourflower trichloris, and little bluestem; woody plants include desert yaupon and vine ephedra; and forbs include Engelmann-daisy and bushsunflower.

With continuous heavy grazing by livestock, twoflower trichloris, fourflower trichloris, and little bluestem decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, pink pappusgrass, and fall witchgrass. If heavy grazing

Figure 10.—Citrus orchard on Willacy fine sandy loam, 0 to 1 percent slopes. The lined canal is used for irrigation.

continues for many years, mesquite, blackbrush, condalias, pricklypear, and other woody plants form a dense canopy that has an understory of red lovegrass, red grama, threeawn, and sandburs. Brush encroachment on this soil is a major range management problem.

Potential is high for habitat for deer, javelina, and coyote. Nesting areas are plentiful for doves, quail, and songbirds.

Potential is high for urban and recreation uses.

This Willacy soil is in capability subclass IIc, nonirrigated, and in class I, irrigated; it is in the Sandy Loam range site.

71—Willacy fine sandy loam, 1 to 3 percent slopes. This deep, gently sloping soil is on convex uplands. Areas are irregular in shape and range from 10 to 150 acres.

Typically, the surface layer is dark grayish brown fine sandy loam about 16 inches thick. The upper part of the subsoil, from 16 to 34 inches, is grayish brown sandy clay loam. The lower part, from 34 to 43 inches, is pale brown sandy clay loam. The layer extending from 43 to 65 inches is very pale brown sandy clay loam. The soil is noncalcareous to 34 inches.

This soil is well drained. Surface runoff is medium, and permeability is moderate. The available water capacity is high. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thin surface layer because of cutting, and in a few areas all of the surface layer has been removed. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are small areas of Hargill, Hidalgo, and Delfina soils. Also included are a few areas of soils that contain secondary lime at a depth of less than 36 inches. The included soils make up less than 15 percent of this map unit.

This Willacy soil is used mostly as irrigated and nonirrigated cropland and for citrus.

This soil has high potential for nonirrigated and irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. This soil has high potential for citrus.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, conserving soil moisture, and controlling erosion are necessary. Cropping systems that include high residue crops help maintain soil tilth, reduce evaporation, provide organic matter, and control soil blowing. Land leveling reduces erosion and runoff and permits a better distribution of irrigation water. Subsurface tile drainage lowers the high water table that can develop from irrigation if the soil is bench leveled. Temporary field ditches are difficult to maintain. If the soil is not irrigated, contour farming helps reduce soil losses from erosion. Stripcropping helps control soil blowing.

Potential is high for nonirrigated and irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain pasture grasses. Improved bermudagrass, buffelgrass, introduced bluestems, and similar grasses are suited to this soil.

Potential is high for rangeland. In open grassland, the dominant grasses in the potential plant community consist of twoflower trichloris, fourflower trichloris, and little bluestem; woody plants include desert yaupon and vine ephedra; and forbs include Engelmann-daisy and bushsunflower.

With continuous heavy grazing by livestock, twoflower trichloris, fourflower trichloris, and little bluestem decrease in the plant community. These plants are replaced by the less desirable hooded windmillgrass, pink pappusgrass, and fall witchgrass. If heavy grazing continues for many years, mesquite, blackbrush, condalias, pricklypear, and other woody plants form a dense canopy that has an understory of red lovegrass, red grama, threeawn, and sandburs. Brush encroachment on this soil is a major range management problem.

Potential is high for habitat for deer, javelina, and coyote. Nesting areas are plentiful for doves, quail, and songbirds.

Potential is high for urban and recreation uses.

This Willacy soil is in capability subclass IIe, nonirrigated and irrigated; it is in the Sandy Loam range site.

72—Willacy-Urban land complex, 0 to 3 percent slopes. This map unit consists of nearly level to gently sloping Willacy soil and Urban land in areas so intricately mixed that it was not practical to separate them because of the scale selected for mapping. Areas are small and irregular in shape and range from 10 to 100 acres. Boundaries commonly coincide with the outer limits of subdivisions, built-up areas, and cities.

Willacy soil makes up 40 to 80 percent of this complex, Urban land 15 to 55 percent, and other soils 5 to 10 percent.

Typically, the surface layer of the Willacy soil is dark grayish brown fine sandy loam about 13 inches thick. The upper part of the subsoil, from 13 to 38 inches, is brown sandy clay loam. The lower part, from 38 to 49 inches, is pale brown sandy clay loam. The layer extending from 49 to 65 inches is very pale brown sandy clay loam. The soil is noncalcareous to a depth of 38 inches.

Urban land consists of soils that are covered by single or multiple-unit dwellings, garages, sidewalks, patios, driveways, streets, schools, churches, shopping centers on less than 40 acres, office buildings, paved parking lots, and industrial sites. In some areas the Willacy soil has been altered by cutting or grading, and in some areas 6 to 24 inches of loamy fill material cover the surface layer.

Included in mapping are areas of Delfina, Hidalgo, and Racombes soils.

Potential is high for urban uses. Potential is high for landscaping and gardening. Most flowers, shrubs, and trees grown in the county are well suited to this soil.

This map unit was not assigned to a capability subclass or to a range site.

73—Zalla loamy fine sand, undulating. This deep, undulating soil is on the active flood plain of the Rio Grande. Slopes are mainly less than 2 percent but range from 1 to 5 percent. Most areas are hummocky and are along the inside curves of, and next to, the Rio Grande. A few areas are narrow and elongated and are parallel to the river. Areas of this soil range from 10 to 60 acres.

Typically, the surface layer is light gray loamy fine sand about 9 inches thick. The layer extending from 9 to 65 inches is very pale brown fine sand. There are thin strata of contrasting textures throughout the soil. The soil is calcareous throughout.

This soil is somewhat excessively drained. Surface runoff is slow. Permeability is rapid. The available water capacity is low. Lower areas of this soil next to the river are flooded occasionally each year for a few days by the water released from Falcon Reservoir during peak periods of irrigation. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is moderate, and the hazard of soil blowing is severe.

Included with this soil in mapping are small areas of Rio Grande and Camargo soils. Also included are areas of a soil consisting of small dunes formed by the wind and small areas of thin overwash that consists of clayey or silty sediment. The included soils make up less than 15 percent of this map unit.

This Zalla soil is idle or is used as pastureland. This soil has low potential for use as cropland. Maintaining or improving soil tilth and adapting cropping systems to the soil limitations are necessary. Crop residue left on or near the surface helps control soil blowing. This soil is not suitable for citrus.

Potential is low for nonirrigated pasture grasses and medium for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain established grasses. Common or improved bermudagrass is suited to this soil.

Potential is medium for rangeland, although no areas are used as rangeland. Potential is medium for habitat for coyote, weasel, white-winged doves, quail, and songbirds.

Potential is low for urban and recreation uses because of the hazard of flooding.

This Zalla soil is in capability subclass IVw, nonirrigated and irrigated; it is in the Vega range site.

74—Zalla silt loam. This deep, nearly level soil is on active flood plains of the Rio Grande. Areas are small and irregular in shape and range from 5 to 75 acres.

Typically, the surface layer is pale brown silt loam about 8 inches thick. The layer extending to a depth of 65 inches is pale brown very fine sand. Thin strata of contrasting textures occur throughout the soil. The soil is calcareous throughout.

This soil is somewhat excessively drained. Surface runoff is slow, and permeability is rapid. The available water capacity is low. This soil is rarely flooded; however, flooding is possible for brief periods during tropical storms. A few areas of this soil have been altered by land leveling for irrigation. In these areas the soil has a thin surface layer because of cutting. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are small areas of Rio Grande and Camargo soils. These soils make up less than 15 percent of this map unit.

This Zalla soil is used entirely as irrigated cropland.

Potential is low for nonirrigated and irrigated crops. Suitable nonirrigated crops are cotton and grain sorghum. Suitable irrigated crops are cotton, grain sorghum, sugarcane, and cool and warm season vegetables. Potential is low for citrus because of the hazard of flooding.

If this soil is used as cropland, maintaining or improving soil tilth, managing irrigation water, and controlling erosion are necessary. Cropping systems that include high-residue crops help to improve or maintain soil tilth, reduce evaporation, provide organic matter, and control soil blowing. Land leveling reduces erosion and runoff and permits better distribution of irrigation water. Because of the sandy material below the surface layer, land leveling cuts should be made carefully. Back filling with loamy material is generally needed. The high lime content of this soil can cause chlorosis in some plants. Temporary field ditches are difficult to maintain.

Potential is low for nonirrigated pasture grasses and medium for irrigated pasture grasses. Proper stocking, fertilizing, rotation grazing, and controlling weeds are needed to maintain pasture grasses. Common or improved bermudagrass is suited to this soil.

Potential is medium for rangeland, although no areas of this soil are used as rangeland. Most areas of this soil have been cleared and are continuously cultivated; however, a few areas remain undisturbed. Potential is medium for habitat for coyote weasel, armadillo, white-winged doves, quail, and songbirds.

Potential is low for urban and recreation uses because of the hazard of flooding.

This Zalla soil is in capability subclass IVc, nonirrigated, and IIIs, irrigated; it is in the Loamy Bottomland range site.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops, pasture, and rangeland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the predicted yields of the main crops and hay and pasture plants are presented for each soil.

This section provides information about the overall agricultural potential of the county and about the management needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Detailed soil map units." Managers for individual fields or farms should also consider the detailed information given in the description of each soil.

More than 624,000 acres in the county was used for crops and pasture in 1978. Of this total 334,000 acres was used for irrigated cropland, mainly cotton (fig. 11); 145,000 acres was used for nonirrigated cropland, mainly grain sorghum; 90,000 acres was used for irrigated citrus orchards; and 55,000 acres was used as pastureland.

The soils in Hidalgo County have good potential for increased production of food. About 75,000 acres of potentially good cropland is used as rangeland and about 25,000 acres is pastureland. In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by using the latest crop production technology with cropland. This soil survey can help facilitate the application of such technology.

Acreage in crops and pasture has gradually been decreasing as more and more land is used for urban development. In 1967, about 64,500 acres was urban and built-up land. This figure has been growing at the rate of about 1,000 acres per year.

Soil erosion is the major concern on about one-fourth of the cropland and pastureland in Hidalgo County. If slope is more than 1 percent, erosion is a hazard. Brennan, Delfina, Hargill, Hidalgo, McAllen, and Willacy soils, for example, have slopes of 1 to 3 percent and have a surface of fine sandy loam.

Loss of the surface layer through erosion is damaging because productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a clayey subsoil and on soils that have a layer in or below the subsoil that limits the depth of the root zone. Such layers include indurated caliche, as in Cuevitas, Delmita, and Randado soils. Erosion also reduces productivity on soils that are droughty, such as Comitas, Hebbronville, and McAllen soils.

Erosion control provides protective surface cover, reduces runoff, and increases infiltration. A cropping system that keeps plant cover on the soil for extended periods can hold soil erosion losses to amounts that will

Figure 11.—Irrigated cotton, defoliated and ready for harvest, on Hidalgo sandy clay loam, 0 to 1 percent slopes.

not reduce the productive capacity of the soils. On livestock farms, which require pasture and hay, the grass forage crops in the cropping system reduce erosion and improve tilth for the following crop.

Minimizing tillage and leaving crop residue on the surface help increase infiltration and reduce the hazards of runoff and wind erosion. These practices can be adapted to most soils in the county, but they are more difficult to use sucessfully on the soils that have a clayey surface layer, such as Harlingen, Mercedes, Matamoros, and Runn soils. Minimum tillage for grain sorghum, which is increasing, is effective in reducing erosion and can be adapted to most soils in the county.

Contouring and stripcropping are erosion control practices in the county. They are best adapted to soils that have smooth, uniform slopes, including most areas of the Delfina, Hargill, and Willacy soils.

Soil blowing is a hazard on the sandy Comitas, Delfina, Nueces, and Sarita soils and on the loamy Brennan, Hargill, McAllen, and Willacy soils. Soil blowing can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or crop residue. Vegetative cover, crop residue, or rough surfaces minimize soil blowing on these soils. Stripcropping of small grains, sorghum, or sudan hybrids is common on sandy soils where melons and other vegetables are planted.

Information about erosion control for each kind of soil is available from the local office of the Soil Conservation Service.

Soil drainage is the major need on most of the soils that are used for irrigated crops and pasture in Hidalgo County. A few soils are so saline that the production of crops common to the area is generally not possible. These are the saline phases of the Harlingen, Hidalgo, Mercedes, Racombes, Raymondville, Reynosa, Rio, and Runn soils, which make up about 14,000 acres in the county.

Unless artificially drained, the somewhat poorly drained soils in the county are so wet that crops are damaged. These soils are the Rio and Grulla soils, which make up about 12,800 acres.

Raymondville, Runn, and Matamoros soils are moderately well drained, but they tend to dry out slowly after rains. Small areas of wetter soils along drainageways and in potholes are commonly included in areas of the well drained Brennan, Hargill, Hidalgo, McAllen, and Willacy soils. Artificial drainage is needed in these wetter areas.

The design of both surface and subsurface drainage systems varies with the kind of soil. A combination of

surface drainage and tile drainage is needed in most areas of the irrigated soils used for intensive row cropping or citrus. Drainage may be more closely spaced in slowly permeable soils than in more permeable soils. Tile drainage removes water very slowly in Raymondville, Olmito, Rio, and Runn soils. Tile drainage is usually not recommended for the clayey Harlingen and Mercedes soils. Finding adequate outlets for tile drainage systems is difficult in some parts of the county.

Information on drainage design for each kind of soil is available in the local office of the Soil Conservation Service.

Soil fertility is naturally high in most soils on uplands in Hidalgo County. Except for the sandy soils, which are slightly acid, upland soils are neutral through moderately alkaline. The soils on flood plains, such as Camargo, Matamoros, Rio Grande, and Zalla soils, are moderately alkaline and are naturally higher in plant nutrients than most soils on uplands. Tiocano, Rio, and Ramadero soils in low potholes and along drainageways are neutral through moderately alkaline.

Most soils in the county are alkaline in their natural state. Levels of available phosphorus and potassium are medium to high in most of these soils. On all soils, additions of fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer to apply.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous.

Many of the soils on the flood plains that are used for crops have a surface layer of silt loam that is light in color and low in organic matter content. Generally the structure of such soils is weak, and intense rainfall causes the formation of a crust on the surface. The crust is hard when dry and nearly impervious to water. Once the crust forms, it reduces infiltration and increases runoff. Regular additions of crop residue, manure, and other organic material can help improve soil tilth and reduce crust formation.

The Grulla, Harlingen, Matamoros, Mercedes, Olmito, Rio, and Runn soils are clayey, and tilth is a concern because the soils often stay wet after heavy rainfall. If they are wet when plowed, they tend to be cloddy when dry, making it difficult to prepare a good seedbed. Post harvest plowing on such wet soils generally results in good tilth at planting time.

Field crops suited to the soils and climate of the county include cotton, grain sorghum, sugarcane, and corn. Other crops can be grown if economic conditions are favorable.

Special crops grown commercially in the county are vegetables, melons, citrus, and nursery plants. Because of the mild winter climate, two growing seasons are possible. Crops such as cabbage, broccoli, carrots, onions, lettuce, peppers, cauliflower, celery, beets, and turnips are cool-season crops grown during fall and winter (fig. 12). Warm-season crops such as okra, squash, potatoes, tomatoes, cucumbers, cantaloupe, and watermelons are grown during spring and early in summer. Grapefruit, oranges, and avocados are the most important tree fruits grown in the county.

Deep soils that have good natural drainage and that warm up early in spring are especially well suited to many vegetables, citrus, and row crops. In the survey area, these are the Brennan, Hargill, Hidalgo, and Willacy soils that have slopes of less than 3 percent; they make up about 370,000 acres. Also, if irrigated the Delfina, Delmita, and McAllen soils that have slopes of less than 3 percent are well suited to vegetables and citrus.

If adequately drained, the irrigated clayey soils in the county are well suited to a wide range of field and vegetables crops. Harlingen, Runn, Matamoros, Olmito, Mercedes, and Raymondville soils make up about 136,000 acres in the county.

Most of the well drained soils in the county are suitable for citrus orchards or crops. Soils in low positions where drainage is poor, however, generally are poorly suited to vegetables, field crops, or orchards.

Latest information and suggestions for growing special crops can be obtained from the local office of the Cooperative Extension Service or the Soil Conservation Service.

Farming is competing with other land uses for large areas of the county. About 64,500 acres, or nearly 6.5 percent, of the county was urban or built-up land in 1967, according to the Conservation Needs Inventory (*14*). Much of this acreage was well suited to crops. Each year additional land is developed for urban uses near McAllen, Edinburg, Mission, Pharr, and Weslaco.

In general, the soils in the county that are well suited to crops are also well suited to urban development. The data about specific soils in this soil survey can be used in planning future land use patterns. Potential productive capacity in farming should be weighed against soil limitations and potential for nonfarm development.

In some areas, however, the soils are well suited to farming but poorly suited to nonfarm development. These areas are identified as map unit 12 on the general soil map at the back of this publication. In these areas the dominant soils are Rio Grande, Matamoros, and Camargo soils, all of which are subject to flooding. The flooding is a serious hazard to nonfarm development. Most areas of these soils, however, produce high yields of farm crops.

Some soils are only moderately well suited to farming but are generally well suited to nonfarm development, for example, the Delmita and Randado soils in map unit 5 on the general soil map. These soils are underlain by caliche at a depth of less than 40 inches, but the nearly

Figure 12.—Irrigated vegetables on a terrace and flood plain of the Rio Grande. Reynosa silty clay loam (foreground) and Matamoros silty clay have high potential for use as cropland. The wooded area is on Grulla clay.

level soils that have good drainage are suited to residential and other urban uses.

The soils on flood plains are suited to vegetables. They also provide good habitat for wetland wildlife. They are poorly suited to urban uses.

pasture

In 1967, according to the Conservation Needs Inventory of that year (*14*), 3.5 percent, or about 35,000 acres, of Hidalgo County land was used for permanent pasture. In 1978, 5.5 percent, or about 55,000 acres, was pasture. For this land use, introduced species of perennial grasses normally are planted and used for forage production.

The more important irrigated grasses are Coastal bermudagrass or other improved bermudagrasses; the nonirrigated pastures are mainly buffelgrass or one of the improved bluestem grasses. Forage is used either for grazing by livestock or is harvested as hay.

Management of pasture includes fertilizer, weed and brush control, and proper stocking rates. Fertilizer requirements are related to soil type, plant species, and the desired level of forage production. A soil test should be made to insure that the correct amount of fertilizer is applied for the desired results. A proper stocking rate means that the number of grazing animals is in balance with the productive capacity of the grass. Weeds and brush, which compete with the desirable plants for the available moisture and nutrients, can be controlled by mowing or using adapted herbicides. Weeds are normally a minor problem on well fertilized and properly grazed pasture.

irrigation

About 429,650 acres in Hidalgo County have a water allotment for irrigation from the Rio Grande. That acreage is irrigated each year. In some years, water from wells is used to irrigate an additional 5,000 to 15,000 acres. The main crops are cotton, grain sorghum, vegetables, citrus, and sugarcane. Soil conservation on irrigated land includes (1) leveling to control soil erosion, to obtain efficient use of irrigation water, to make efficient use of rainfall, and to facilitate farming operations; (2) irrigation pipelines to conserve water, to reduce labor, and to eliminate barriers to farming operations, for example, open irrigation ditches; (3) surface irrigation systems, including level-furrow (fig. 13) and level-border methods of irrigation; (4) irrigation water management; (5) surface drainage; and (6) subsurface drainage tile to lower the high water table to leach salts from saline soils. About 5,000 acres are irrigated by drip irrigation, and about 5,000 acres are irrigated by sprinkler irrigation.

Irrigation water from the Rio Grande varies from 600 to 1,200 parts per million of dissolved sodium and chloride salts, depending upon the season and rainfall (*17*). The natural salinity of some of the soils and the salt content of the irrigation water, along with inadequate drainage, have contributed to the salinity problem (*19*). About half of the irrigation area has a high water table and salinity problem. The water table is within 2 to 6 feet of the surface during part of the year.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the

Figure 13.—Furrows carry water for irrigation on Harlingen clay.

way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, or for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit (*18*). Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed soil map units."

rangeland

Tomas M. Dominguez, range conservationist, Soil Conservation Service, helped prepare this section.

About 30 percent of Hidalgo County is rangeland. About 6 percent of the farm income is derived from livestock, mainly cattle. Cow-calf-steer operations are dominant in the county. The average size of a ranch is 2,500 acres, but six ranches in the county are 10,000 acres or more in size.

On some ranches the forage produced on rangeland is supplemented by crop stubble and improved pasture. In winter the native forage is often supplemented with protein concentrate. Creep feeding of calves and yearlings to increase market weight is practiced on a few ranches.

The native vegetation in many parts of the county has been greatly depleted by continued excessive use. Much of the acreage that was once open grassland is now covered with mixed brush, weeds, and cactus. The amount of forage produced may be less than half the potential because of brush encroachment.

Nearly all of the rangeland in Hidalgo County is in the northern half of the county. In the northernmost part, the soils are deep sands and loamy sands. These soils support tall and mid grasses. The potential productivity of forage is medium to low because the available water capacity is low in the sandy surface layer. There are small areas of hummocks and sand hills; soil blowing is a severe hazard.

In the central part of the county, the soils are moderately deep or shallow fine sandy loams over indurated caliche (fig. 14). These soils support short and mid grasses. Potential productivity of forage is medium to low, although these soils are more productive than the deep sandy soils. The soils in the western part of the county are deep fine sandy loams. These soils support tall and mid grasses, and the potential productivity of forage is medium to high.

In the southwestern part of the county there are small outcroppings of very shallow, gravelly loams over gravel-embedded, indurated caliche. These soils support short grasses. The potential productivity of forage is low because of the shallow rooting depth and the low available water capacity.

The major concern on most of the rangeland is management of grazing so that the kinds and amounts of plants that make up the potential plant community are maintained or reestablished. Controlling brush and minimizing soil blowing are also important management concerns. If sound range management based on the soil survey information and rangeland inventories is applied, the potential is excellent for increasing the productivity of range in the area.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of

Figure 14.—Area of Delmita-Randado complex, 0 to 1 percent slopes, in Red Sandy Loam range site.

soil. Effective management is based on the relationship between the soils and plants and water.

Table 8 shows, for each soil, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to rangeland are listed. Explanation of the column headings in table 8 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

One primary objective of range management is to regulate grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management

Figure 15.—Landscaping with suitable shrubs and trees on Brennan fine sandy loam, 0 to 1 percent slopes.

generally results in the optimum production of plants, reducing undesirable brush species, conserving water, and controlling water erosion and soil blowing. Dependent upon the land user's objectives, sometimes a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

gardening and landscaping

Calvin G. Lyons, Jr., horticulturist, Texas Agricultural Extension Service, helped prepare this section.

Information in this section can be used by homeowners, gardeners, nurserymen, landscapers, and horticulturists to plan the kinds of flowers, shrubs, and trees that are best suited to a particular soil. In some areas plants control erosion.

Soils in Hidalgo County that are well suited to yard and garden plants have a deep root zone, a loamy texture, a balanced supply of plant nutrients, plenty of organic matter, adequate water-supplying capacity, good drainage, and good tilth, which allows free movement of water, air, and roots (fig. 15). The degree of alkalinity or acidity is also important in the suitability of plants to particular soils. For example, roses, most annual flowers, most vegetables, and most grasses generally do well in soils that are neutral or only slightly acid. In this county, plants requiring an acid soil should not be planted because most of the soils are alkaline. However, some plants that are grown in calcareous alkaline soils, such as the Hidalgo soils, develop chlorosis, a yellowing of the leaves. This iron deficiency can usually be corrected by applications of either chelated iron fertilizer or iron-rich foliar sprays.

Table 9 lists soils in the county and some of the flowers, shrubs, and trees that are suited to each soil. Saline soils, Pits, and Urban land are not rated because they are not suited to plants. In general a plant suited to a soil grows well only in a soil that has properties that favor that plant. For example, a plant that needs good drainage is suited only to a well drained soil. If this plant is grown in another soil, drainage, using tile drains or raised beds, must be provided.

Generally, conditioning natural soils is less expensive and more advisable than replacing them with manmade soil material. Soil amendments and fertilizer, however, should be added according to the results of soil tests and the needs of the plants. One important amendment to the soil is organic matter, which can be peat moss, compost, rotted sawdust, or manure. Generally, at least 2 inches of organic matter should be added to the soil and incorporated manually or with a rototiller into the upper 6 inches of the natural soil. For clayey soils at least 2 inches of sand, perlite, or vermiculite should also be added. To help neutralize a high lime soil, either elemental sulphur or ammonium sulfate (21-0-0) can be used.

In some areas of the county, the soils are so clayey or so poorly drained that constructing raised beds to grow flowers and some shrubs is necessary. Brick, tile, metal, or wood make good retainers along the edge for raised beds. Beds should be filled with good soil material and well-balanced physical and chemical amendments. Some areas of the county have shallow or sandy soils. Although most garden and ornamental plants can be grown on these soils, more frequent watering and fertilizing will be necessary.

All plants, whether grown in natural or manmade soil, require careful maintenance, especially during the period of establishment. Good management includes fertilizing, watering, controlling weeds, and controlling insects. The main factors that affect gardening in this county are high temperatures for long periods, the high alkalinity of the soil, and soluble salts in the water.

Gardening and landscaping should be included in the basic plans for urban construction. The potential of the natural soil for growing plants should be considered when selecting the site. Also important is the protection of existing trees during construction. For more detailed guidelines on gardening and landscaping, consult the local office of the Soil Conservation Service or the Agricultural Extension Service.

recreation

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

wildlife habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, grain sorghum, oats, and sunflowers.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are kleingrass, lovegrass, switchgrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, partridgepea, and grama.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are agarita, guajillo, wolfberry, and lantana.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millets, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for *openland wildlife* consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, dove, chachalaca, meadowlark, field sparrow, cottontail, and red fox.

Habitat for *wetland wildlife* consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, rails, muskrat, mink, and beaver.

Habitat for *rangeland wildlife* consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include deer, wild turkey, bobcat, javelina, and coyote.

engineering

Billy J. Garner, civil engineer, Soil Conservation Service, helped prepare this section.

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed

performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations before design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to cemented pan, hardness of cemented pan within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 13 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to a cemented pan, and flooding affect absorption of the effluent. Large stones and a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are

free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over a cemented pan or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as caliche, shale, and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic

matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; and susceptibility to flooding. Excavating and grading and the stability of ditchbanks are affected by depth to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 19.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GM, GC, SP, SM, and SC; silty and clayey soils as ML, CL, and CH. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 19.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the county and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

physical and chemical properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 17, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding may occur anytime from November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Cemented pans are cemented or indurated subsurface layers within a depth of 5 feet. Such pans cause difficulty in excavation. Pans are classified as thin or thick. A thin pan is less than 3 inches thick if continuously indurated or less than 18 inches thick if discontinuous or fractured. Excavations can be made by trenching machines, backhoes, or small rippers. A thick pan is more than 3 inches thick if continuously indurated or more than 18 inches thick if discontinuous or fractured. Such a pan is so thick or massive that blasting or special equipment is needed in excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class,

total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

engineering index test data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil series and their morphology." The soil samples were tested by the Texas State Department of Highways and Public Transportation.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Specific gravity (particle index)—T 100 (AASHTO), D 653 (ASTM); and Shrinkage—T 92 (AASHTO), D 427 (ASTM).

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*20*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 20, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Fluvent (*Fluv*, meaning river, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Ustifluvents (*Usti*, meaning dry, plus *fluvent*, the suborder of the Entisols that have a dry moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Ustifluvents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-silty, mixed, calcareous, hyperthermic, Typic Ustifluvents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series. An example is the Rio Grande series, a member of the coarse-silty, mixed, hyperthermic family of Typic Ustifluvents.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*16*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*20*). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Benito series

The Benito series consists of deep, poorly drained, clayey soils on ancient stream terraces. These soils formed in thick beds of saline clayey and silty alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Benito clay, from the intersection of Farm Road 493 and Texas Highway 374 (Business U.S. Highway 83) in Donna, 2 miles south on Farm Road 493, 0.5 mile east on county road, 0.2 mile north of county road, and 200 feet west, in a field:

A11—0 to 7 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; massive; very hard, very firm, very sticky and very plastic; saline; calcareous; moderately alkaline; clear smooth boundary.

A12—7 to 56 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate fine angular blocky structure in upper part; in the lower part, common wedge-shaped peds that have long axes tilted 30 to 60 degrees from the horizontal and parting to moderate fine angular blocky structure; very hard, very firm, very sticky and plastic; common threads of salt; saline; calcareous; moderately alkaline; diffuse boundary.

AC—56 to 65 inches; light gray (10YR 6/1) clay, gray (10YR 5/1) moist; distinct intersecting slickensides; wedge-shaped peds that have long axes tilted 30 to 60 degrees from the horizontal, parting to moderate fine angular blocky structure; very hard, very firm, very sticky and plastic; few threads of salt; saline; calcareous; strongly alkaline.

Thickness of the solum ranges from 50 to 72 inches. These soils, when dry, have cracks 0.5 inch to 3 inches wide that form at the surface and extend to a depth of 20 inches or more. Intersecting slickensides begin 10 to 20 inches below the surface. The axes of the parallelepipeds are tilted 30 to 60 degrees from the horizontal and part to moderate, fine or medium angular blocky structure.

The 10- to 40-inch layer is 60 to 70 percent clay and 1 to 4 percent sand. Soil salinity ranges from 4 to more than 16 millimhos per centimeter in the 10- to 40-inch layer and increases with depth. Exchangeable sodium increases with depth and may exceed 15 percent below 20 inches. Reaction is moderately alkaline or strongly alkaline.

The A horizon is gray or light gray. The AC horizon is light gray or light brownish gray. Chroma of 1 or less extends to 40 inches or more.

Some pedons have a IIC horizon of silt loam, silty clay loam, or silty clay beginning at a depth of 55 to 72 inches.

Brennan series

The Brennan series consists of deep, well drained, loamy soils on uplands. These soils formed in alkaline loamy sediments partly reworked by wind. Slopes range from 0 to 3 percent.

Typical pedon of Brennan fine sandy loam, 0 to 1 percent slopes, from the intersection of Farm Road 1925 and U.S. Highway 281, 3.7 miles west on Farm Road 1925, 3.2 miles north on county road, 0.1 mile east on county road, and 75 feet north, in a citrus orchard:

Ap—0 to 6 inches; dark brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; massive; hard, friable; many fine pores; many fine roots; neutral; abrupt smooth boundary.

A1—6 to 13 inches; dark brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; slightly hard, friable; many fine pores; many fine roots; neutral; clear smooth boundary.

B2t—13 to 29 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, friable; many fine pores; few fine roots; few thin clay films on faces of peds; mildly alkaline; diffuse boundary.

B3—29 to 47 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; hard, friable; few films, threads, and soft bodies of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

Cca—47 to 65 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; massive; hard, friable; about 5 percent, by volume, soft bodies and concretions of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 28 to 52 inches. Depth to secondary carbonate ranges from 17 to 34 inches.

The A horizon is dark grayish brown, grayish brown, dark brown, or brown. Organic matter content is less than 1 percent. Reaction of the soil is neutral or mildly alkaline.

The Bt horizon is brown, yellowish brown, or strong brown. It is sandy clay loam or loam and has a clay content of 18 to 30 percent. Reaction is mildly alkaline or moderately alkaline. The B3 horizon is brown, pale brown, yellowish brown, light yellowish brown, or strong brown. It is sandy clay loam or loam. Reaction is mildly alkaline or moderately alkaline.

The Cca horizon is pale brown, light yellowish brown, very pale brown, or light brown. It is sandy clay loam or loam.

Camargo series

The Camargo series consists of deep, well drained, silty soils on bottom lands. These soils formed in thick beds of calcareous silty alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Camargo silt loam, from the intersection of El Texano Road and U.S. Highway 281 in Hidalgo, 0.48 mile west on El Texano Road, 0.7 mile south on private road to International Boundary and Water Commission levee, 0.4 mile southeast on field road, and 75 feet east, in a field:

Ap—0 to 8 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable; few mica flakes; calcareous; moderately alkaline; abrupt smooth boundary.

C1—8 to 20 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; few fine

brownish yellow mottles along root channels; massive; hard, friable; common fine pores; evident, thin bedding planes; few mica flakes; calcareous; moderately alkaline; clear wavy boundary.

C2—20 to 33 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; few fine brownish yellow mottles along root channels; massive; slightly hard, friable; many fine pores; large unaltered bedding planes; few mica flakes; calcareous; moderately alkaline; clear wavy boundary.

C3—33 to 50 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; few fine brownish yellow mottles along faces of cleavage planes; massive; slightly hard, friable; few fine pores; large unaltered bedding planes; few mica flakes; calcareous; moderately alkaline; gradual wavy boundary.

C4—50 to 65 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 5/3) moist; slightly hard, friable; thin unaltered bedding planes; few mica flakes; calcareous; moderately alkaline.

The 10- to 40-inch layer of soil ranges from silt loam to silty clay loam and has a clay content of 18 to 35 percent. Bedding planes are evident, and there are strata of contrasting textures of clay to very fine sandy loam throughout.

The A horizon is grayish brown, light brownish gray, or pale brown. It is silt loam or silty clay loam.

The C horizon is grayish brown, light brownish gray, brown, or pale brown. It is silt loam or silty clay loam. Cleavage planes along unaltered bedding planes are weakly expressed to strongly expressed. The sediment below a depth of 40 inches is stratified layers that range from very fine sandy loam to silty clay.

Cameron series

The Cameron series consists of deep, moderately well drained, clayey soils on ancient stream terraces. These soils formed in thick beds of calcareous clayey and loamy alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Cameron silty clay, from the intersection of Farm Road 1015 and U.S. Highway 281 in Progreso, 1.5 miles east on U.S. Highway 281, 0.25 mile north on county road, 0.1 mile west on field road, and 75 feet north, in a field:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; very hard, very firm but crumbly, sticky and plastic; few fine pores; few snail shell fragments; calcareous; moderately alkaline; clear smooth boundary.

A1—8 to 18 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; very hard, very firm but crumbly, sticky and plastic; few fine pores; few snail shell fragments; calcareous; moderately alkaline; clear smooth boundary.

B2—18 to 30 inches; brown (10YR 5/3) silty clay; dark brown (10YR 4/3) moist; moderate fine subangular blocky structure; hard, firm but crumbly, sticky and plastic; many fine pores; few films and threads of calcium carbonate; few vertical streaks of A1 material in filled cracks; calcareous; moderately alkaline; abrupt smooth boundary.

IIC—30 to 65 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable; few soft bodies of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum to a contrasting loamy layer ranges from 22 to 30 inches. These soils, when dry, have cracks 0.4 to 1.5 inches wide that form at the surface and extend to a depth of 20 inches or more. COLE ranges from 0.10 to 0.15 in the upper part of the 10- to 40-inch layer. The upper part has a weighted average clay content of 40 to 60 percent. The lower part of the 10- to 40-inch layer is loamy and has a weighted average clay content of 15 to 35 percent; it is 40 to 55 percent silt.

The A horizon is gray, dark grayish brown, grayish brown, or brown.

The B horizon is gray, grayish brown, light brownish gray, or brown. It is silty clay, clay, or silty clay loam.

The IIC horizon is brown, pale brown, or light brown. It is silt loam or loam and has a clay content ranging from 10 to 26 percent. Secondary carbonates range from a few to about 4 percent, by volume, in the form of weakly cemented concretions and soft bodies.

Comitas series

The Comitas series consists of deep, well drained, sandy soils on uplands. These soils formed in sandy and loamy sediments that have been reworked by wind. Slopes range from 0 to 3 percent.

Typical pedon of Comitas loamy fine sand, 0 to 3 percent slopes, from the intersection of Farm Road 490 and U.S. Highway 281, 3.3 miles west on Farm Road 490, and 150 feet south, in rangeland:

A1—0 to 28 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) moist; massive; slightly hard, very friable; many very fine pores; common fine roots; neutral; abrupt smooth boundary.

B2t—28 to 49 inches; reddish yellow (7.5YR 6/6) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; hard, friable; many fine pores; few thin clay films on faces of peds and around pores; mildly alkaline; gradual smooth boundary.

B3—49 to 72 inches; reddish yellow (7.5YR 7/6) fine sandy loam, strong brown (7.5YR 5/6) moist; weak fine subangular blocky structure; hard, friable; few

fine pores; few thin clay films around pores; few films and threads of calcium carbonate in lower part of horizon; calcareous; moderately alkaline; gradual smooth boundary.

C—72 to 80 inches; reddish yellow (7.5YR 8/6) fine sandy loam, reddish yellow (7.5YR 6/6) moist; massive; hard, friable; few films and threads of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 60 to 84 inches. Thickness of the loamy fine sand surface layer ranges from 20 to 32 inches. Depth to secondary carbonate ranges from 36 to 60 inches.

The A horizon is dark brown, dark grayish brown, grayish brown, or brown. Organic matter content is less than 1 percent. Reaction of the soil is slightly acid or neutral.

The B2t horizon is dark brown, pale brown, brown, light brown, reddish brown, reddish yellow, or strong brown. It is fine sandy loam or sandy clay loam and has a clay content of 16 to 24 percent. Reaction is slightly acid to mildly alkaline. The B3 horizon is yellow, brownish yellow, reddish yellow, or strong brown. It is fine sandy loam or sandy clay loam. Reaction is mildly alkaline or moderately alkaline.

The C horizon is brownish yellow, very pale brown, reddish yellow, or pink. It is fine sandy loam or sandy clay loam.

Cuevitas series

The Cuevitas series consists of very shallow to shallow, well drained, loamy soils on uplands. These soils formed in loamy materials partly reworked by wind over thick beds of caliche. Slopes range from 0 to 3 percent.

Typical pedon of Cuevitas fine sandy loam in an area of Randado-Cuevitas complex, 0 to 3 percent slopes, from the intersection of Farm Road 681 and Farm Road 1017 in Puerto Rico, 3.6 miles south on Farm Road 681, and 250 feet east, in a pasture:

A1—0 to 8 inches; reddish brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; massive; hard, very friable; many fine roots; neutral; abrupt wavy boundary.

Ccam—8 to 12 inches; pinkish white (7.5YR 8/2) strongly cemented caliche; pendants of calcium carbonate on lower side of cemented layer; calcareous; moderately alkaline; gradual wavy boundary.

Cca—12 to 60 inches; pinkish white (7.5YR 8/2) weakly cemented caliche; massive but contains a few fractures; calcareous; moderately alkaline.

Thickness of the A horizon, or depth to indurated caliche, ranges from 7 to 12 inches. Reaction is neutral or mildly alkaline. The A horizon is reddish brown, dark brown, or brown.

The Ccam horizon (petrocalcic) and the Cca horizon are pinkish white or white. The Ccam is indurated or strongly cemented caliche becoming softer with depth.

Delfina series

The Delfina series consists of deep, moderately well drained, loamy soils on uplands. These soils formed in alkaline loamy sediments reworked by wind. Slopes range from 0 to 3 percent.

Typical pedon of Delfina fine sandy loam, 0 to 1 percent slopes, from the intersection of Farm Road 493 and Farm Road 490 in Hargill, 1.5 miles north on Farm Road 493, and 100 feet west, in a field:

Ap—0 to 9 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, friable; many fine pores; neutral; abrupt smooth boundary.

A1—9 to 13 inches; brown (10YR 5/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine pores; neutral; abrupt smooth boundary.

B21t—13 to 20 inches; brown (7.5YR 5/2) sandy clay loam, dark brown (7.5YR 4/2) moist; common medium distinct reddish yellow (5YR 6/6) and few fine faint grayish brown mottles; strong medium blocky structure; extremely hard, firm; few fine pores; thick continuous clay films and dark coatings on vertical and horizontal faces of peds; organic coatings are black (10YR 2/1) moist; neutral; gradual smooth boundary.

B22t—20 to 28 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; common medium distinct brownish yellow (10YR 6/6) mottles; moderate fine blocky structure; extremely hard, firm; few fine pores; thick continuous clay films on faces of peds; mildly alkaline; gradual smooth boundary.

B23t—28 to 34 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; few fine distinct brownish yellow mottles; moderate fine blocky structure; very hard, firm; many clay films on faces of peds; mildly alkaline; clear smooth boundary.

B24t—34 to 39 inches; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; few fine faint brownish yellow mottles; weak fine blocky structure; very hard, firm; few thin clay films on faces of peds; mildly alkaline; clear smooth boundary.

B3tca—39 to 72 inches; pink (7.5YR 7/4) sandy clay loam, light brown (7.5YR 6/4) moist; weak fine subangular blocky structure; hard, firm; few thin clay films on faces of peds; about 3 to 5 percent, by volume, soft bodies and concretions of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 60 to 80 inches. Depth to secondary carbonate ranges from 36 to 60 inches (fig. 16).

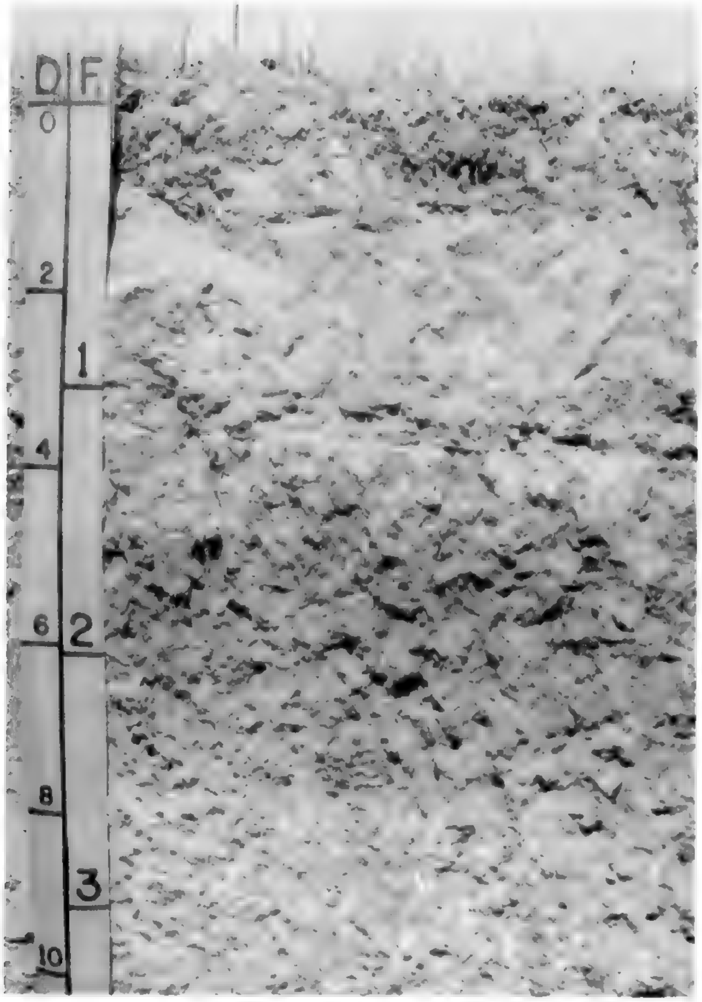


Figure 16.—Profile of Delfina fine sandy loam, 0 to 1 percent slopes. An abrupt boundary, at a depth of about 13 inches, is between the surface layer and the Bt horizon. Depth is indicated in decimeters (Dm) and in feet (Ft). Multiply the figure on the left by 10 to determine the depth in centimeters.

The A horizon is dark grayish brown, dark brown, grayish brown, or brown. It is fine sandy loam or loamy fine sand. Organic matter content is less than 1 percent. Reaction of the soil is slightly acid to mildly alkaline.

The Bt horizon is dark brown, brown, dark grayish brown, pale brown, yellowish brown, or light brown. Mottles are yellowish red, reddish yellow, strong brown, grayish brown, or brownish yellow. Pedons that have a matrix chroma of 3 or more have mottles that have a chroma of 2 or less. This horizon is sandy clay loam or clay loam and has a clay content of 25 to 35 percent. Reaction is mildly alkaline or moderately alkaline. The Btca horizon is light brown, pink, reddish yellow, pale brown, light yellowish brown, or very pale brown. It is sandy clay loam or fine sandy loam.

Delmita series

The Delmita series consists of moderately deep, well drained, loamy and sandy soils on uplands. These soils formed over thick beds of caliche in loamy materials partly reworked by wind. Slopes range from 0 to 3 percent.

Typical pedon of Delmita fine sandy loam, in an area of Delmita-Randado complex, 0 to 1 percent slopes, from the intersection of Farm Road 1017 and U.S. Highway 281 in San Manuel, 2.3 miles west on Farm Road 1017, 3.2 miles south on county road, 0.1 mile west on field road, and 50 feet south, in a field:

Ap—0 to 7 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; massive; hard, friable; many fine pores; neutral; abrupt wavy boundary.

A1—7 to 13 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; hard, friable; many fine pores; neutral; clear smooth boundary.

B2t—13 to 34 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; moderate coarse prismatic structure parting to moderate fine subangular blocky; hard, friable; many fine pores; few clay skins on faces of peds; mildly alkaline; abrupt wavy boundary.

IICcam—34 to 60 inches, pinkish white (7.5YR 8/2) indurated caliche; pendants of calcium carbonate on lower side of indurated layer becoming less cemented or concretionary with depth; calcareous; moderately alkaline.

Thickness of solum, or depth to indurated caliche, ranges from 20 to 40 inches. Reaction is neutral or mildly alkaline.

The A horizon is reddish brown, yellowish red, brown, or strong brown. It is fine sandy loam or loamy fine sand.

The Bt horizon is reddish brown, red, or yellowish red. It is sandy clay loam or fine sandy loam and has a clay content of 18 to 30 percent.

The IICcam horizon is pinkish white or white. It is indurated to strongly cemented caliche becoming less cemented with depth.

Falfurrias series

The Falfurrias series consists of deep, somewhat excessively drained, sandy soils on uplands. These soils formed in eolian sands. Slopes range from 0 to 5 percent.

Typical pedon of Falfurrias fine sand, 0 to 5 percent slopes, from the intersection of Farm Road 1017 and U.S. Highway 281 in San Manuel, 6.4 miles west on Farm Road 1017, 4.85 miles north on ranch road, and 75 feet west, in rangeland:

A11—0 to 6 inches; light brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) moist; single grained; loose, very friable; many fine roots; slightly acid; smooth boundary.

A12—6 to 25 inches; light brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) moist; single grained; loose, very friable; many fine roots; slightly acid; gradual wavy boundary.

C—25 to 80 inches; pink (7.5YR 7/4) fine sand, light brown (7.5YR 6/4) moist; single grained; loose, very friable; neutral.

Combined thickness of the A and C horizons ranges from 80 to 90 inches or more. Texture in the upper 40 inches ranges from fine sand to loamy fine sand; the clay content is 1 to 9 percent. Reaction ranges from slightly acid to mildly alkaline.

The A horizon is grayish brown, brown, light brownish gray, pale brown, light yellowish brown, or light brown. Reaction is slightly acid or neutral.

The C horizon is pale brown, very pale brown, yellow, pink, or reddish yellow. Reaction is slightly acid to mildly alkaline.

Grulla series

The Grulla series consists of deep, somewhat poorly drained, clayey soils on bottom lands. These soils formed in thick beds of calcareous clayey alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Grulla clay, from the intersection of U.S. Highway 83 and U.S. Highway 281 in Pharr, 7 miles south on U.S. Highway 281, 0.6 mile south on county road, 0.8 miles west on International Boundary and Water Commission levee, 0.15 mile south on field road, and 25 feet west, in a field:

Ap—0 to 7 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; massive; extremely hard, very firm, sticky and plastic; calcareous; moderately alkaline; clear wavy boundary.

C1—7 to 25 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; many coarse distinct brownish yellow (10YR 6/8) mottles on the outside of some clay fragments; the fragments are variable in size but are mainly about 2 inches across; the interfaces are dull and not shiny; extremely hard, very firm, sticky and plastic; few fine pores; distinct horizontal cleavage planes; calcareous; moderately alkaline; clear wavy boundary.

C2—25 to 47 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; few coarse distinct strong brown (7.5YR 5/6) mottles on the outside of some clay fragments; very hard, very firm, sticky and plastic; few fine pores; bedding planes are evident; calcareous; moderately alkaline; abrupt wavy boundary.

Ab—47 to 59 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; weak fine angular blocky structure; very hard, very firm, sticky and plastic; few fine pores; calcareous; moderately alkaline; clear wavy boundary.

C3—59 to 65 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; few fine distinct yellowish brown mottles along the interfaces of the fragments; massive; very hard, very firm, sticky and plastic; calcareous; moderately alkaline.

The texture of the 10- to 40-inch layer of the soil ranges from silty clay to clay and has a clay content of 45 to 60 percent. The soils, when dry, have cracks 0.5 inch to 3 inches wide that form at the surface and extend to a depth of 20 inches or more. Bedding planes are evident throughout the soil. Some pedons have stratified loamy layers ranging from 1 to 2 inches in thickness below a depth of 40 inches.

The A horizon is grayish brown, light brownish gray, or pale brown. This layer generally contains recent sediment that is clay loam, silty clay, or clay and is 30 to 70 percent clay.

The C horizon is grayish brown, light brownish gray, or pale brown silty clay or clay. The sediment below a depth of 40 inches is stratified, and the strata range from silt loam to silty clay.

Hargill series

The Hargill series consists of deep, well drained, loamy soils on uplands. These soils formed in loamy sediments partly reworked by wind. Slopes range from 0 to 5 percent.

Typical pedon of Hargill fine sandy loam, 0 to 1 percent slopes, from the intersection of U.S. Highway 281 and Texas Highway 107 in Edinburg, 5 miles north on U.S. Highway 281, 2.65 miles east on Farm Road 2812 from its intersection with U.S. Highway 281 and 100 feet north, in a field:

Ap—0 to 8 inches; brown (7.5YR 4/2) fine sandy loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine pores; neutral; abrupt smooth boundary.

A1—8 to 18 inches; brown (7.5YR 4/2) fine sandy loam, dark brown (7.5YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable; many fine pores; neutral; clear smooth boundary.

B21t—18 to 25 inches; reddish brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; weak coarse prismatic structure parting to weak fine blocky; hard, friable; many fine pores; common thin clay films on faces of peds and in pores; mildly alkaline; gradual smooth boundary.

B22t—25 to 47 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; moderate medium prismatic structure parting to weak fine subangular blocky; hard, friable; many fine pores; many thin clay films on faces of peds; mildly alkaline; gradual smooth boundary.

B23t—47 to 63 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak fine subangular blocky structure; hard, friable; few thin clay films on faces of peds; mildly alkaline; gradual smooth boundary.

B3—63 to 71 inches; reddish yellow (7.5YR 7/6) sandy clay loam, reddish yellow (7.5YR 6/6) moist; weak fine subangular blocky structure; hard, friable; calcareous in lower part; moderately alkaline; gradual smooth boundary.

C—71 to 80 inches, reddish yellow (7.5YR 7/6) sandy clay loam, reddish yellow (7.5YR 6/6) moist; massive; hard, friable; few threads of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 60 to 80 inches. Depth to secondary carbonate ranges from 36 to more than 60 inches.

The A horizon is dark brown or brown. Reaction is neutral or mildly alkaline.

The Bt horizon is reddish brown, yellowish red, reddish yellow, dark brown, or light brown. It is sandy clay loam and has a clay content of 21 to 33 percent. Reaction is neutral to moderately alkaline.

The B3 horizon is reddish yellow, brown, or light brown.

The C horizon is pink, reddish yellow, or light brown.

Harlingen series

The Harlingen series consists of deep, moderately well drained, clayey soils on ancient stream terraces. These soils formed in thick beds of clayey alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Harlingen clay, from the intersection of Farm Road 1423 and Texas Highway 374 (Business U.S. Highway 83), 2.85 miles south of Farm Road 1423, 0.15 mile west on county road, and 100 feet north, in a field:

Ap—0 to 8 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; massive; very hard, very firm, very sticky and plastic; calcareous; moderately alkaline; clear smooth boundary.

A11—8 to 18 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate fine angular blocky structure; very hard, very firm, very sticky and plastic; few snail shell fragments; calcareous; moderately alkaline; gradual wavy boundary.

AC1—18 to 35 inches; brown (7.5YR 5/2) clay, dark brown (7.5YR 4/2) moist; moderate medium angular blocky structure; many intersecting slickensides; parallelepipeds that have long axes tilted 10 to 45 degrees from the horizontal; very hard, very firm, very sticky and plastic; few films and threads of calcium carbonate; calcareous; moderately alkaline; diffuse boundary.

AC2—35 to 58 inches; brown (7.5YR 5/2) clay, dark brown (7.5YR 4/2) moist; weak fine blocky structure; many intersecting slickensides; parallelepipeds that have long axes tilted 10 to 45 degrees from the horizontal; very hard, very firm, very sticky and plastic; calcareous; moderately alkaline; diffuse boundary.

AC3—58 to 72 inches; brown (7.5YR 5/2) clay, dark brown (7.5YR 4/2) moist; few intersecting slickensides and parallelepipeds; very hard, very firm, very sticky and plastic; few soft bodies of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 50 to 72 inches. These soils, when dry, have cracks 0.5 inch to 3.0 inches wide that form at the surface and extend to a depth of 20 inches or more. Intersecting slickensides begin 20 to 30 inches below the surface. The axes of the parallelepipeds are tilted 10 to 45 degrees from the horizontal. The 10- to 40-inch layer is 60 to 70 percent clay. Soil salinity ranges from 2 to 8 millimhos per centimeter in the upper 35 inches and 4 to 16 millimhos per centimeter below this depth. In saline pedons, salinity ranges from 4 to more than 16 millimhos per centimeter. Exchangeable sodium increases with depth and ranges from 6 percent in the upper part of the solum to about 25 percent in the lower part.

The A horizon is grayish brown or brown. Moist values are about 1 unit less than dry values. The AC horizon is brown or grayish brown. It is clay, and in some pedons it has strata of loamy sediments below a depth of 55 inches.

Hebbronville series

The Hebbronville series consists of deep, well drained, loamy soils on uplands. These soils formed in alkaline loamy sediments that have been reworked by wind. Slopes range from 0 to 5 percent.

Typical pedon of Hebbronville sandy loam, 0 to 1 percent slopes, from the intersection of Farm Road 490 and U.S. Highway 281, 9.7 miles west on Farm 490, 1.3 miles north on county road, and 75 feet south, in a field:

Ap—0 to 7 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, friable; many fine pores; neutral; abrupt smooth boundary.

A1—7 to 17 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; slightly hard, friable; many fine pores; neutral; gradual smooth boundary.

B2t—17 to 39 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, friable; many fine pores; few thin clay films on faces of peds; few films and threads of calcium carbonate in lower part; mildly alkaline; gradual smooth boundary.

B3—39 to 58 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C—58 to 65 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; slightly hard, friable; massive; few films and threads and soft lumps of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 50 to 63 inches. Depth to secondary carbonate ranges from 24 to 60 inches.

The A horizon is dark grayish brown, grayish brown, brown, or pale brown (10YR 6/3). Organic matter content is less than 1 percent. Reaction is neutral or mildly alkaline.

The Bt horizon is brown, pale brown, yellowish brown, light yellowish brown, or strong brown. It is fine sandy loam and has a clay content of 12 to 18 percent. Reaction is neutral or mildly alkaline. The B3 horizon is yellowish brown, brown, light brown, light yellowish brown, or strong brown. Reaction is mildly alkaline or moderately alkaline.

The C horizon is light brown, light yellowish brown, or very pale brown.

Hidalgo series

The Hidalgo series consists of deep, well drained, loamy soils on uplands. These soils formed in calcareous loamy and clayey sediments. Slopes range from 0 to 5 percent.

Typical pedon of Hidalgo sandy clay loam, 0 to 1 percent slopes, from the intersection of U.S. Highway 83 and Main Street in Donna, 1.1 miles west on U.S. Highway 83, 1.3 miles north on county road, and 300 feet west, in a field:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; weak subangular blocky and fine granular structure; hard, friable; few small snail shell fragments; calcareous; moderately alkaline; clear smooth boundary.

A1—9 to 17 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; weak fine subangualr blocky structure; hard, friable; many fine and very fine pores; few wormcasts; calcareous; moderately alkaline; diffuse smooth boundary.

B2—17 to 28 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate fine subangular blocky structure; hard, friable; many fine and very fine pores; few threads and films of segregated calcium carbonate; few wormcasts; few snail shell fragments; calcareous; moderately alkaline; diffuse smooth boundary.

B2ca—28 to 38 inches; pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, friable; many fine and very fine pores; few snail shell fragments; about 10 percent, by volume, soft bodies of calcium carbonate; calcareous; moderately alkaline; diffuse smooth boundary.

Cca—38 to 80 inches; very pale brown (10YR 7/3) clay loam, brown (10YR 5/3) moist; massive; hard, friable; many fine and very fine pores; few snail shell fragments; about 10 percent, by volume, soft bodies of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 30 to 50 inches. Depth to secondary carbonate in the form of films and threads ranges from 16 to 28 inches (fig. 17). Some pedons are noncalcareous to a depth of 24 inches. Texture of the 10- to 40-inch layer is sandy clay loam. The layer is 23 to 35 percent clay. Soil salinity ranges from 1 to 4 millimhos per centimeter. In saline pedons, salinity ranges from 4 to more than 16 millihos per centimeter. Reaction is moderately alkaline throughout.

The A horizon is dark grayish brown, grayish brown, dark brown, or brown. It is sandy clay loam or fine sandy loam.

The B horizon is grayish brown, light brownish gray, brown, pale brown, or light brown. It is sandy clay loam or clay loam.

The C horizon is light brownish gray, light gray, pale brown, very pale brown, or light brown. It is sandy clay loam or clay loam and 5 to 35 percent, by volume, calcium carbonate in the form of weakly cemented concretions and soft bodies.

Jimenez series

The Jimenez series consists of very shallow to shallow, excessively drained, gravelly loamy soils on uplands. These soils formed in thick beds of gravelly caliche. Slopes range from 1 to 8 percent.

Typical pedon of Jimenez very gravelly loam, in an area of Jimenez-Quemado complex, 1 to 8 percent slopes, from the intersection of U.S. Highway 83 and Farm Road 886, 0.8 mile south on Farm Road 886, and 50 feet east, in rangeland:

A1—0 to 8 inches; brown (10YR 5/3) very gravelly loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, friable; 50 percent, by volume, of waterworn chert, conglomerate, limestone, and basalt pebbles; calcareous; moderately alkaline; abrupt wavy boundary.

Ccam—8 to 10 inches; white (10YR 8/2) strongly cemented caliche with about 35 percent of the mass

Figure 17.—Profile of Hidalgo sandy clay loam, 0 to 1 percent slopes. Calcium carbonate has accumulated in the lower part. Depth is indicated in decimeters (Dm) and in feet (Ft). Multiply the figure on the left by 10 to determine the depth in centimeters.

consisting of embedded gravel; pendants of calcium carbonate on lower side of cemented layer becoming softer with depth; calcareous; moderately alkaline; gradual wavy boundary.

Cca—10 to 60 inches; white (10YR 8/2) weakly cemented caliche; massive; contains about 50 percent embedded gravel; calcareous; moderately alkaline.

Thickness of the A horizon or depth to indurated caliche ranges from 7 to 14 inches. Gravel content ranges from 50 to 80 percent.

The A horizon is dark grayish brown, brown, grayish brown, or brown. It is very gravelly loam and has a clay content of 12 to 24 percent in the fine earth fraction.

The C horizon is strongly cemented in the upper part becoming less cemented with depth.

Laredo series

The Laredo series consists of deep, well drained, silty soils on ancient stream terraces. These soils formed in thick beds of silty alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Laredo silty clay loam, from the intersection of U.S. Highway 281 and Farm Road 1015 in Progreso, 6.2 miles east on U.S. Highway 281, 0.5 mile north on county line road, 0.15 mile west on field road, and 50 feet north, in a field:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, friable; few mica flakes; few snail shell fragments; calcareous; moderately alkaline; abrupt smooth boundary.

A1—8 to 14 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, friable; many fine pores; few wormcasts; few snail shell fragments; calcareous; moderately alkaline; clear smooth boundary.

B2—14 to 47 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable; many fine pores; many films and threads of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

C—47 to 65 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable; calcareous; moderately alkaline.

Thickness of the solum ranges from 34 to 50 inches. Thin strata of silt loam, silty clay loam, and very fine sandy loam are within a depth of 34 to 50 inches. Depth to secondary carbonates in the form of films, threads, and soft bodies ranges from 18 to 34 inches. The 10- to 40-inch layer is silt loam or silty clay loam and is 18 to 35 percent clay and less than 15 percent sand that is coarser than very fine sand.

The A horizon is dark grayish brown or dark brown.

The B horizon is grayish brown, brown, or pale brown. It is silt loam or silty clay loam.

The C horizon is light brownish gray or very pale brown. It is silt loam, silty clay loam, or very fine sandy loam.

Matamoros series

The Matamoros series consists of deep, moderately well drained, clayey soils on bottom lands. These soils formed in thick beds of calcareous clayey alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Matamoros silty clay, from the intersection of Texas Highway 374 (Business U.S. Highway 83) and Farm Road 2557 in San Juan, 7 miles

south on Farm Road 2557, 0.5 mile south on gravel road, 0.25 mile east and 0.25 mile south on field road, and 75 feet west, in a field:

Ap—0 to 7 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; massive; very hard, firm, sticky and plastic; calcareous; moderately alkaline; abrupt smooth boundary.

C1—7 to 15 inches; light brownish gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) moist; massive; very hard, very firm, sticky and plastic; many fine pores; bedding planes evident; calcareous; moderately alkaline; diffuse boundary.

C2—15 to 22 inches; light brownish gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) moist; few fine faint yellowish brown mottles; massive; very hard, very firm, sticky and plastic; common fine pores; bedding planes evident; calcareous; moderately alkaline; clear wavy boundary.

A1b—22 to 26 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; weak blocky structure; very hard, very firm, sticky and plastic; remnants of leaves in various stages of decomposition are embedded in faces of peds; calcareous; moderately alkaline; clear wavy boundary.

C3—26 to 65 inches; light brownish gray (10YR 6/2) silty clay, grayish brown (10YR 5/2) moist; few fine faint yellowish brown mottles along cleavage planes; massive; very hard, very firm, sticky and plastic; silty clay consists of angular fragments that have dull faces and no definite pattern of cleavage; calcareous; moderately alkaline.

The texture of the 10- to 40-inch layer of the soil ranges from silty clay loam to silty clay. The layer is 35 to 55 percent clay. Cleavage planes along unaltered bedding planes are weakly expressed to strongly expressed. These soils, when dry, have cracks 0.4 inch to 1.5 inches wide that form at the surface and extend to a depth of 20 inches or more. COLE ranges from 0.07 to 0.15 in the 10- to 40-inch layer.

The A horizon is light brownish gray, grayish brown, pale brown, or brown.

The C and Ab horizons are light brownish gray, grayish brown, or pale brown. They are silty clay loam or silty clay and have thin strata of loamy sediment. The sediment below a depth of 40 inches is stratified, and the strata range from silt loam to clay.

McAllen series

The McAllen series consists of deep, well drained, loamy soils on uplands. These soils formed in calcareous loamy sediments partly reworked by wind. Slopes range from 0 to 5 percent.

Typical pedon of McAllen fine sandy loam, 0 to 1 percent slopes, from the intersection of Farm Road 2058 and Farm Road 681 in McCook, 3.3 miles south on Farm Road 2058, and 100 feet west, in a field:

Ap—0 to 6 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; many fine pores; few snail shell fragments; calcareous; moderately alkaline; abrupt smooth boundary.

A1—6 to 14 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; soft, very friable; many fine pores and root channels; few snail shell fragments; calcareous; moderately alkaline; gradual smooth boundary.

B2—14 to 37 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; slightly hard, friable; many fine pores and root channels; few films and threads of calcium carbonate in the upper part, increasing in the lower part; few snail shell fragments; calcareous; moderately alkaline; diffuse smooth boundary.

Cca—37 to 72 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable; few snail shell fragments; about 15 percent, by volume, of soft bodies and concretions of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 28 to 48 inches. Secondary carbonates in the form of films and threads are at depths of 15 to 25 inches. Texture of the 10- to 40-inch layer is sandy clay loam or clay loam. The layer is 18 to 30 percent clay.

The A horizon is grayish brown, light brownish gray brown, or pale brown. It is fine sandy loam or sandy clay loam.

The B horizon is light brownish gray, brown, or pale brown. It is sandy clay loam or clay loam.

The C horizon is pale brown or very pale brown. It is sandy clay loam or clay loam and has 15 to 35 percent, by volume, calcium carbonate in the form of strongly cemented concretions and soft bodies.

Mercedes series

The Mercedes series consists of deep, moderately well drained, clayey soils on uplands. These soils formed in calcareous clayey sediment. Slopes range from 0 to 5 percent, although in most areas they are less than 0.5 percent.

Typical pedon of Mercedes clay, 0 to 1 percent slopes, from the intersection of Farm Road 1015 and Texas Highway 107 in Edcouch, 4 miles south on Farm Road 1015, 1 mile east on county road, 0.2 mile north on county road, and 100 feet west, in a field:

Ap—0 to 8 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; massive; hard, firm, very sticky

and very plastic; few snail shell fragments; calcareous; moderately alkaline; abrupt smooth boundary.

A12—8 to 19 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate fine angular blocky structure; hard, firm, very sticky and very plastic; few snail shell fragments; calcareous; moderately alkaline; gradual wavy boundary.

A13—19 to 30 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate fine angular blocky structure; many intersecting slickensides; very hard, very firm, very sticky and plastic; few snail shell fragments; calcareous; moderately alkaline; gradual wavy boundary.

AC—30 to 57 inches; light brownish gray (10YR 6/2) clay, grayish brown; few gray streaks along filled cracks; moderate fine angular blocky structure; many intersecting slickensides; parallelepipeds that have long axes tilted 10 to 45 degrees from the horizontal; very hard, very firm, very sticky and very plastic; calcareous; moderately alkaline; gradual smooth boundary.

C—57 to 65 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; massive; very hard, very firm, very sticky and very plastic; calcareous; moderately alkaline.

Thickness of the solum ranges from 42 to 72 inches. These soils, when dry, have cracks 0.5 inch to 3.0 inches wide that form at the surface and extend to a depth of 20 inches or more. Intersecting slickensides begin 20 to 30 inches below the surface. The axes of the parallelepipeds are tilted 10 to 45 degrees from the horizontal. The 10- to 40-inch layer is clay that ranges from 45 to 60 percent clay and 9 to 21 percent sand. Soil salinity ranges from 2 to 16 millimhos per centimeter.

Exchangeable sodium increases with depth and ranges from 6 to 15 percent within 30 inches of the surface. Reaction of the soil is moderately alkaline or strongly alkaline.

The A horizon is gray or light gray. The AC horizon is grayish brown, light brownish gray, or pale brown.

The C horizon is light brownish gray, pale brown, or very pale brown. In places a IIC horizon of silt loam or very fine sandy loam is below a depth of 55 inches.

Nueces series

The Nueces series consists of deep, moderately well drained, sandy soils on uplands. These soils formed in loamy sediments overlain by eolian sands. Slopes range from 0 to 3 percent.

Typical pedon of Nueces fine sand, 0 to 3 percent slopes, from the intersection of Farm Road 1017 and U.S. Highway 281 in San Manuel, 6.4 miles west on Farm Road 1017, 1.15 miles north on ranch road, and 75 feet west, in rangeland:

A11—0 to 10 inches; brown (10YR 5/3) fine sand, dark brown (10YR 4/3) moist; single grained; loose; many fine roots; slightly acid; gradual smooth boundary.

A12—10 to 29 inches; light brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) moist; single grained; loose; many fine roots; slightly acid; abrupt smooth boundary.

B21t—29 to 42 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; common medium prominent red (2.5YR 4/8) and few fine faint dark grayish brown (10YR 4/2) mottles; moderate coarse prismatic structure parting to moderate medium blocky; extremely hard, firm; few fine pores; common thick clay films on faces of peds; neutral; gradual smooth boundary.

B22t—42 to 54 inches; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; common medium prominent yellowish red (5YR 5/8) and few fine faint yellow mottles; weak fine prismatic structure parting to weak fine blocky; extremely hard, firm; few fine pores; common thick clay films on faces of peds; mildly alkaline; clear smooth boundary.

B3t—54 to 72 inches; very pale brown (10YR 7/4) sandy clay loam, light yellowish brown (10YR 6/4) moist; moderate medium blocky structure; hard, firm; moderately alkaline.

Thickness of the solum ranges from 60 to 84 inches. Thickness of the A horizon ranges from 22 to 39 inches.

The A horizon is brown, light brownish gray, pale brown, light brown, light yellowish brown, or very pale brown. Reaction is slightly acid or neutral.

The B2t horizon is grayish brown, light brownish gray, brown, light brown, or yellowish brown. It is sandy clay loam and has a clay content of 21 to 34 percent. Reaction is neutral to moderately alkaline. The B3t horizon is light yellowish brown, very pale brown, pink, or pale yellow. It is sandy clay loam or sandy loam. Reaction is neutral to moderately alkaline.

Olmito series

The Olmito series consists of deep, moderately well drained, clayey soils on ancient stream terraces. These soils formed in thick beds of clayey alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Olmito silty clay, from the intersection of U.S. Highway 281 and Farm Road 1015 in Progreso, 6.2 miles east on U.S. Highway 281, 0.8 mile north on county line road, 0.1 mile west on field road, and 50 feet north, in a field:

Ap—0 to 8 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium granular structure; hard, friable, sticky and plastic; few mica flakes; few snail shell fragments; calcareous; moderately alkaline; abrupt smooth boundary.

A1—8 to 24 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate fine subangular blocky structure; very hard, firm but crumbly, sticky and plastic; few fine pores; few wormcasts; few snail shell fragments; calcareous; moderately alkaline; clear smooth boundary.
B2ca—24 to 47 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate fine and medium subangular blocky structure; very hard, firm but crumbly, sticky and plastic; few fine pores; shiny pressure faces; few films and threads of calcium carbonate; few concretions of calcium carbonate in lower part; calcareous; moderately alkaline.
Cca—47 to 55 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; massive; hard, firm but crumbly; few concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.
C—55 to 65 inches, pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; massive; hard, friable; calcareous; moderately alkaline.

Thickness of the solum ranges from 33 to 47 inches. Depth to contrasting stratum of silt loam or very fine sandy loam ranges from 40 to 80 inches. These soils, when dry, have cracks 0.4 inch to 1.5 inches wide that form at the surface and extend to a depth of 20 inches or more. COLE ranges from 0.07 to 0.15 throughout the solum. Texture of the 10- to 40-inch layer is silty clay or silty clay loam. This layer is 36 to 55 percent clay and 40 to 60 percent silt.

The A horizon is dark gray, dark grayish brown, grayish brown, or dark brown.

The B horizon is gray, grayish brown, dark brown, or brown. It is silty clay or silty clay loam.

The C horizon is light brownish gray, pale brown, or very pale brown. It is silty clay or silty clay loam. Secondary carbonates range from a few to about 15 percent, by volume, in the form of weakly cemented concretions and soft bodies.

Quemado series

The Quemado series consists of shallow, well drained, gravelly loamy soils on uplands. These soils formed in thick beds of gravelly caliche. Slopes range from 1 to 8 percent.

Typical pedon of Quemado very gravelly sandy loam, in an area of Jimenez-Quemado complex, 1 to 8 percent slopes, from the intersection of U.S. Highway 83 and Farm Road 886, 0.7 mile south on Farm Road 886, and 50 feet east in rangeland:

A1—0 to 6 inches; dark brown (7.5YR 4/4) very gravelly sandy loam, dark brown (7.5YR 3/4) moist; weak fine granular structure; hard, friable; about 50 percent, by volume, waterworn chert, conglomerate, sandstone, and igneous gravel; neutral; clear smooth boundary.
B2t—6 to 12 inches; brown (7.5YR 5/4) very gravelly sandy clay loam, dark brown (7.5YR 3/4) moist; weak fine subangular blocky structure; hard, friable; few thin clay films on faces of peds and coarse fragments; about 55 percent, by volume, waterworn chert, conglomerate, and igneous gravel; neutral; abrupt wavy boundary.
Ccam—12 to 18 inches; pinkish white (7.5YR 8/2) strongly cemented caliche with about 40 percent of the mass consisting of embedded gravel; pendants of calcium carbonate on lower side of cemented layer which is softer with depth; calcareous; moderately alkaline; gradual wavy boundary.
Cca—18 to 60 inches; pinkish white (7.5YR 8/2) weakly cemented caliche; massive; about 50 percent of embedded gravel; calcareous; moderately alkaline.

Thickness of the solum ranges from 10 to 20 inches. Gravel content ranges from 30 to 90 percent. Reaction ranges from slightly acid to mildly alkaline.

The A horizon is dark brown or brown. It has a clay content of 10 to 18 percent in the fine earth fraction.

The Bt horizon is dark brown or brown. It is very gravelly sandy clay loam and has a clay content of 18 to 27 percent in the fine earth fraction.

The C horizon is pinkish white or white. It is moderately or strongly cemented in the upper part and becomes less cemented with depth.

Racombes series

The Racombes series consists of deep, well drained, loamy soils on uplands. These soils formed in alkaline loamy sediments. Slopes range from 0 to 1 percent.

Typical pedon of Racombes sandy clay loam, from the intersection of Texas Highway 107 and Farm Road 491 in La Villa, 3.5 miles east on Texas Highway 107, 0.6 mile north on county road, 0.4 mile east on field road, and 75 feet south, in a field:

Ap—0 to 6 inches; very dark gray (10YR 3/1) sandy clay loam, black (10YR 2/1) moist; moderate fine granular structure; slightly hard, friable; many fine pores; mildly alkaline; clear smooth boundary.
A1—6 to 13 inches; very dark gray (10YR 3/1) sandy clay loam, black (10YR 2/1) moist; moderate fine subangular blocky structure; slightly hard, friable; many fine pores; mildly alkaline; clear smooth boundary.
B21t—13 to 25 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium blocky structure; hard, friable; many fine pores; few thin clay films on faces of peds; mildly alkaline; clear smooth boundary.
B22t—25 to 37 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; weak medium

prismatic structure parting to moderate medium blocky; very hard, firm; common fine pores; few thin clay films on faces of peds; mildly alkaline; clear smooth boundary.

B3—37 to 49 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; few faint strong brown mottles; weak subangular blocky structure; hard, friable; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

Cca—49 to 65 inches; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; few faint strong brown mottles; massive; hard, friable; common soft bodies and concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C—65 to 72 inches; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; massive; few soft bodies and concretions of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 40 to 60 inches. The mollic epipedon ranges from 20 to 33 inches thick. Depth to secondary carbonate ranges from 24 to 50 inches. Soil salinity ranges from 1 to 16 millimhos per centimeter.

The A horizon is very dark gray, very dark grayish brown, dark gray, or dark grayish brown. Reaction is neutral or mildly alkaline.

The Bt horizon is very dark grayish brown, dark grayish brown, dark brown, grayish brown, or brown. It is sandy clay loam or clay loam and has a clay content of 26 to 34 percent. Reaction is neutral to moderately alkaline. The B3 horizon is brown, light brownish gray, or pale brown. It is sandy clay loam or clay loam. Reaction is mildly alkaline or moderately alkaline.

The C horizon is light brown, pale brown, or very pale brown. It is sandy clay loam.

Ramadero series

The Ramadero series consists of deep, well drained, loamy soils in long, narrow drainageways on uplands. These soils formed in alkaline loamy sediments. Slopes range from 0 to 1 percent.

Typical pedon of Ramadero sandy clay loam, from the intersection of Farm Road 681 and Farm Road 2058 in McCook, 4 miles south and 2 miles east on Farm Road 2058, 2.75 miles east on Farm Road 681, 1.75 miles north on county road, and 300 feet west, in a field.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) sandy clay loam, very dark brown (10YR 2/2) moist; weak fine granular structure; hard, friable; many fine pores; mildly alkaline; abrupt smooth boundary.

A1—8 to 21 inches; very dark grayish brown (10YR 3/2) sandy clay loam, very dark brown (10YR 2/2) moist; weak fine subangular blocky structure; hard, friable; common fine pores; mildly alkaline; clear smooth boundary.

B21—21 to 27 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to moderate medium blocky; hard, friable; few fine pores; mildly alkaline; clear smooth boundary.

B22—27 to 39 inches, brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; few fine pores; common thin clay films on faces of peds; mildly alkaline; clear smooth boundary.

B3—39 to 53 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; hard, firm; calcareous; moderately alkaline; gradual smooth boundary.

C—53 to 65 inches; very pale brown (10YR 7/4) sandy clay loam, light yellowish brown (10YR 6/4) moist; massive; hard, firm; calcareous; moderately alkaline.

Thickness of the solum ranges from 40 to 60 inches. The mollic epipedon ranges from 20 to 30 inches thick. Depth to secondary carbonate ranges from 24 to 30 inches. These soils receive extra sediments from surrounding soils, and in unplowed areas the overwash ranges from 3 to 18 inches thick.

The A horizon is dark grayish brown, grayish brown, very dark grayish brown, brown, dark gray, or dark brown. Reaction is neutral to moderately alkaline.

The B horizon is brown, grayish brown, light brownish gray, yellowish brown, dark grayish brown, or pale brown. It is sandy clay loam or clay loam and has a clay content of 25 to 34 percent. Reaction is neutral to moderately alkaline. The B3 horizon is light yellowish brown, pale brown, brown, light brownish gray, or brown. It is sandy clay loam or clay loam.

The C horizon is very pale brown, pale brown, light yellowish brown, or yellowish brown. It is sandy clay loam or clay loam. Segregated lumps and concretions of calcium carbonate range from 1 to 20 percent, by volume.

Randado series

The Randado series consists of shallow, well drained, loamy soils on uplands. These soils formed in loamy materials partly reworked by wind over thick beds of caliche (fig. 18). Slopes range from 0 to 3 percent.

Typical pedon of Randado fine sandy loam in an area of Randado-Cuevitas complex, 0 to 3 percent slopes, from the intersection of Farm Road 681 and Farm Road 1017 in Puerto Rico, 3.65 miles south on Farm Road 681, and 250 feet east, in a pasture:

A1—0 to 9 inches; reddish brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak fine granular structure; hard, very friable; many fine roots; neutral; clear smooth boundary.

Figure 18.—Profile of Randado fine sandy loam in an area of the Delmita-Randado complex, 0 to 1 percent slopes. This soil has a layer of indurated caliche. Depth is indicated in decimeters (Dm) and in feet (Ft). Multiply the figure on the left by 10 to determine the depth in centimeters.

B2t—9 to 16 inches; reddish brown (5YR 5/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; weak fine prismatic structure parting to weak fine subangular blocky; hard, friable; many fine pores; many fine roots; few thin clay films on faces of peds; mildly alkaline; abrupt smooth boundary.

Ccam—16 to 20 inches; pinkish white (7.5YR 8/2) strongly cemented caliche; pendants of calcium carbonate on lower side of cemented layer; calcareous; moderately alkaline; gradual wavy boundary.

Cca—20 to 60 inches; pinkish white (7.5YR 8/2) weakly cemented caliche; massive but contains a few fractures; calcareous; moderately alkaline.

Thickness of solum ranges from 11 to 20 inches. Reaction is neutral or mildly alkaline.

The A horizon is red, reddish brown, yellowish red, dark brown, brown, or strong brown.

The Bt horizon has the same color range as the A horizon. It is fine sandy loam or sandy clay loam and has a clay content of 16 to 25 percent.

The C horizon is pinkish white or white. It is indurated or strongly cemented caliche becoming less cemented with depth.

Raymondville series

The Raymondville series consists of deep, well drained, clayey soils on uplands. These soils formed in calcareous clayey sediments. Slopes range from 0 to 1 percent.

Typical pedon of Raymondville clay loam, from the intersection of Farm Road 491 and Texas Highway 107 in La Villa, 5.3 miles northeast on Farm Road 491, 0.1 mile south on county road, and 150 feet west, in a field:

Ap—0 to 8 inches; gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) moist; massive; hard, friable, sticky and plastic; few snail shell fragments; calcareous; moderately alkaline; abrupt smooth boundary.

A1—8 to 15 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; weak fine subangular blocky structure; hard, firm, sticky and plastic; few snail shell fragments; calcareous; moderately alkaline; clear smooth boundary.

B2—15 to 25 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium blocky structure; few wedge-shaped peds; very hard, firm, sticky and plastic; common fine pores; few films and threads of calcium carbonate; calcareous; moderately alkaline; diffuse boundary.

B2ca—25 to 43 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium blocky structure; few wedge-shaped peds; very hard, firm, sticky and plastic; common fine pores; about 5 percent, by volume, soft bodies and concretions of calcium carbonate; calcareous; moderately alkaline; diffuse boundary.

Cca—43 to 51 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; massive; very hard, firm, sticky and plastic; about 5 percent, by volume, concretions and soft lumps of calcium carbonate; strongly calcareous; moderately alkaline; diffuse boundary.

C—51 to 65 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; massive; hard, firm, sticky and plastic; calcareous; moderately alkaline.

Thickness of the solum ranges from 35 to 48 inches. These soils, when dry, have cracks 0.5 inch to 2 inches wide that form at the surface and extend to a depth of

20 inches of more. COLE ranges from 0.07 to 0.17 throughout the solum. In undisturbed areas the soil is weakly cyclic. Within the limits of a pedon, the surface layer in microbasins is dark or very dark gray and on microknolls is gray or grayish brown. The 10- to 40-inch layer is clay loam or clay and has a clay content ranging from 35 to 50 percent. Soil salinity ranges from 1 to 4 millimhos per centimeter increasing with depth. In saline phases, salinity ranges from 4 to more than 16 millimhos per centimeter. The soil is moderately alkaline throughout.

The A horizon is dark gray, gray, dark grayish brown, or grayish brown.

The B horizon is gray, grayish brown, light brownish gray, brown, or pale brown. It is clay loam or clay.

The C horizon is light brownish gray, pale brown, or light gray. It is clay or clay loam and has 5 to 25 percent, by volume, calcium carbonate in the form of weakly cemented concretions and soft bodies.

Reynosa series

The Reynosa series consists of deep, well drained, silty soils on ancient stream terraces. These soils formed in thick beds of silty alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Reynosa silty clay loam, from the intersection of Farm Road 1016 and U.S. Highway 83 in Mission, 3 miles south on Farm Road 1016, 0.35 miles south on county road, and 400 feet east, in a field:

Ap—0 to 8 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable; few mica flakes; few snail shell fragments; calcareous; moderately alkaline; abrupt smooth boundary.

A1—8 to 15 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; hard, friable; common fine pores; few mica flakes; few snail shell fragments; few wormcasts; calcareous; moderately alkaline; gradual smooth boundary.

B2ca—15 to 48 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; hard, friable; common fine pores; few wormcasts and splotches of dark brown decaying organic material; common films and threads of calcium carbonate; few snail shell fragments; calcareous; moderately alkaline; gradual smooth boundary.

C—48 to 65 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive hard, friable; thin strata of silty clay loam; calcareous; moderately alkaline.

Thickness of the solum ranges from 38 to 49 inches. Thin strata of silt loam, silty clay loam, or silty clay are within a depth of 30 to 50 inches. Depth to secondary lime in the form of films, threads, and soft bodies ranges from 14 to 34 inches. The 10- to 40-inch layer is silt loam or silty clay loam and has 18 to 35 percent clay and less than 15 percent sand that is coarser than very fine sand. Soil salinity ranges from 1 to 4 millimhos per centimeter. In saline phases, salinity ranges fom 4 to more than 16 millimhos per centimeter.

The A horizon is grayish brown, light brownish gray, or brown.

The B horizon is grayish brown, light brownish gray, brown, or pale brown. It is silt loam or silty clay loam.

The C horizon is light brownish gray, pale brown, or very pale brown. It is silt loam or silty clay loam.

Rio series

The Rio series consists of deep, somewhat poorly drained, loamy soils on upland enclosed depressional areas. These soils formed in clayey sediments. Slopes range from 0 to 1 percent.

Typical pedon of Rio clay loam, from the intersection of Farm Road 2812 and U.S. Highway 281, 3.25 miles east on Farm Road 2812, and 300 feet north, in a field:

Ap—0 to 6 inches, dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; weak fine granular structure; hard, friable, sticky and plastic; neutral; abrupt smooth boundary.

A1—6 to 12 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; moderate fine subangular blocky structure; hard, friable, sticky and plastic; few fine pores; neutral; clear smooth boundary.

B21t—12 to 18 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; few fine distinct reddish brown and strong brown mottles; moderate medium blocky structure; very hard, very firm, sticky and plastic; few fine pores; clay films on faces of peds; noncalcareous; mildly alkaline; gradual wavy boundary.

B22t—18 to 38 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; few fine distinct brownish yellow and strong brown mottles; moderate medium and fine blocky structure; very hard, very firm, sticky and plastic; few fine pores; clay films on faces of peds; noncalcareous; mildly alkaline; gradual wavy boundary.

B3—38 to 58 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; few fine distinct strong brown mottles; weak medium blocky structure; very hard, very firm, sticky and plastic; patchy clay films on faces of peds; few films of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Cca—58 to 63 inches, light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; massive; very hard, firm, sticky and plastic; about 3 percent,

by volume, soft bodies and concretions of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 34 to 58 inches. Soil salinity ranges from 1 to 4 millimhos per centimeter and remains constant or increases with depth. In saline phases, salinity ranges from 4 to more than 16 millimhos per centimeter.

The A horizon is very dark gray, dark gray, gray, dark grayish brown, or grayish brown. It is clay loam or fine sandy loam. Reaction is neutral or mildly alkaline.

The Bt horizon is very dark gray, dark gray, gray, or grayish brown. Mottles are reddish brown, yellowish red, brownish yellow, strong brown, or gray. This horizon is clay or clay loam and has a clay content of 35 to 50 percent. Reaction is mildly alkaline or moderately alkaline. The B3 horizon is dark gray, gray, grayish brown, light brownish gray, or pale brown. It is clay loam or sandy clay loam.

The C horizon is gray, light brownish gray, pale brown, or very pale brown. It is sandy clay loam, clay loam, or sandy clay. Secondary carbonates range from 1 to 5 percent, by volume, in the form of weakly cemented concretions and soft bodies.

Rio Grande series

The Rio Grande series consists of deep, well drained silty soils on bottom lands. These soils formed in thick beds of calcareous silty alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Rio Grande silt loam, from the intersection of Texas Highway 374 and Farm Road 1427, 4 miles south on Farm Road 1427, 0.8 mile south on field road, and 75 feet west, in a field:

Ap—0 to 8 inches; light brownish gray (10YR 6/2) silt loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable; few mica flakes; calcareous; moderately alkaline; abrupt smooth boundary.

C1—8 to 49 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; few fine brownish yellow mottles along root channels and faces of cleavage planes; massive; slightly hard, friable; many fine pores; evident thin bedding planes; few strata of silty clay loam less than 1 inch thick; few mica flakes; calcareous; moderately alkaline; clear smooth boundary.

C2—49 to 57 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; few fine brownish yellow mottles along faces of cleavage planes; massive; hard, friable; few fine pores; evident unaltered bedding planes; few mica flakes; calcareous; moderately alkaline; clear smooth boundary.

C3—57 to 65 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable; many fine pores; evident thin bedding planes; few mica flakes; calcareous; moderately alkaline.

The texture of the 10- to 40-inch layer of soil ranges from silt loam to very fine sandy loam. The layer is 9 to 18 percent clay. Bedding planes are evident, and there are strata of contrasting textures of clay to loamy fine sand throughout the soil.

The A horizon is grayish brown, light brownish gray, pale brown, or very pale brown. It is silt loam or silty clay loam.

The C horizon is grayish brown, light brownish gray, pale brown, or very pale brown. It is silt loam or very fine sandy loam. Cleavage planes along unaltered bedding planes are weakly expressed to strongly expressed. The sediment below a depth of 40 inches is stratified, and the strata range from fine sand to silty clay.

Runn series

The Runn series consists of deep, moderately well drained, clayey soils on ancient stream terraces. These soils formed in thick beds of clayey alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Runn silty clay, from the intersection of Texas Highway 336 and U.S. Highway 83, 2.5 miles south on Texas Highway 336, 0.1 mile west on field road, and 300 feet north, in a field:

Ap—0 to 8 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate medium granular structure; hard, firm, sticky and plastic; few roots; few fine pores; calcareous; moderately alkaline; abrupt smooth boundary.

A1—8 to 18 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; hard, firm, sticky and plastic; few roots; few fine pores; few snail shell fragments; common wormcasts; calcareous; moderately alkaline; clear smooth boundary.

B2—18 to 38 inches; light brownish gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate fine and medium subangular blocky structure; very hard, firm but crumbly, sticky and plastic; few fine pores; shiny pressure faces; few films and threads of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

Cca—38 to 55 inches; pale brown (10YR 6/3) silty clay, brown (10YR 5/3) moist; massive; hard, firm, sticky and plastic; common fine pores; about 3 percent, by volume, concretions and soft bodies of calcium carbonate; calcareous; moderately alkaline; diffuse wavy boundary.

IICca—55 to 65 inches, pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; massive; hard, firm; few thin strata of silt loam; few soft bodies of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 35 to 55 inches. Depth to strata of silt loam, silty clay, silty clay loam, or very fine sandy loam ranges from 40 to 80 inches. These soils, when dry, have cracks 0.4 inch to 1 inch wide that form at the surface and extend to a depth of 25 to 40 inches. COLE ranges from 0.07 to 0.17 throughout the solum. The 10- to 40-inch layer is silty clay or silty clay loam and has a clay content of 36 to 55 percent and a silt content of 40 to 60 percent. Soil salinity ranges from 1 to 4 millimhos per centimeter and increases with depth. In some saline phases, salinity ranges from 4 to more than 16 millimhos per centimeter.

The A horizon is grayish brown, light brownish gray, or brown.

The B horizon is grayish brown, light brownish gray, or brown. It is silty clay or silty clay loam.

The C horizon is light brownish gray, pale brown, very pale brown, or light brown. It is silty clay, silty clay loam, or silt loam.

Sarita series

The Sarita series consists of deep, well drained, sandy soils on uplands. These soils formed in loamy sediments overlain by eolian sands. Slopes range from 0 to 3 percent.

Typical pedon of Sarita fine sand, 0 to 3 percent slopes, from the intersection of U.S. Highway 281 and Farm Road 1017 in San Manuel, 6 miles north on U.S. 281, 1.4 miles east on ranch road, and 100 feet south, in rangeland:

A1—0 to 8 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; single grained; loose, very friable; common fine roots; slightly acid; clear smooth boundary.

A2—8 to 48 inches; very pale brown (10YR 7/3) fine sand, brown (10YR 5/3) moist; single grained; loose, very friable; few roots; slightly acid; abrupt smooth boundary.

B21t—48 to 52 inches; pale brown (10YR 6/3) fine sandy loam, grayish brown (10YR 5/2) moist; few fine and medium faint yellowish brown mottles; weak blocky structure; extremely hard, friable; common fine pores; few thin clay films on faces of peds; slightly acid; clear smooth boundary.

B22t—52 to 58 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; many medium and coarse distinct strong brown (7.5YR 5/6) and a few fine distinct red mottles; moderate coarse prismatic structure parting to weak blocky; extremely hard, friable; few fine and medium pores; common thick clay films on faces of peds; neutral; gradual smooth boundary.

B3—58 to 80 inches; light yellowish brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/4) moist; weak blocky structure; very hard, friable; moderately alkaline.

Thickness of the solum ranges from 60 to 100 inches. Thickness of the A horizon ranges from 40 to 72 inches.

The upper part of the A horizon is grayish brown, pale brown, light brown, or light brownish gray. The lower part of the A horizon is light gray, pale brown, very pale brown, or light brown. It is slightly acid or neutral.

The Bt horizon is light brownish gray, light gray, pale brown, very pale brown, or light yellowish brown. Mottles are red, yellowish red, reddish yellow, brown, or strong brown. In some pedons there are a few grayish mottles. The Bt horizon is sandy clay loam or fine sandy loam and has a clay content of 18 to 34 percent. Reaction is medium acid to mildly alkaline. The B3 horizon is very pale brown, light yellowish brown, reddish yellow, pale brown, or light gray. It is fine sandy loam or sandy clay loam and has a clay content of 18 to 27 percent. It is mildly alkaline to moderately alkaline.

Tiocano series

The Tiocano series consists of deep, clayey soils in upland enclosed depressional areas. These soils formed in clayey sediments. Slopes range from 0 to 1 percent.

Typical pedon of Tiocano clay, from the intersection of Farm Road 2812 and U.S. Highway 281, 3.9 miles east on Farm Road 2812 and 500 feet north, in a field:

A11—0 to 10 inches; dark gray (10YR 4/1) clay, black (10YR 2/1) moist; moderate fine angular blocky structure; very hard, very firm, very sticky and plastic; common fine pores; few fine roots; mildly alkaline; gradual smooth boundary.

A12—10 to 38 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure; few wedge-shaped peds; distinct slickensides; very hard, very firm, very sticky and plastic; common fine pores; few fine roots; mildly alkaline; gradual wavy boundary.

AC—38 to 52 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate medium blocky structure that forms parallelepipeds that have long axes tilted 30 degrees from the horizontal; distinct intersecting slickensides; very hard, very firm, very sticky and plastic; moderately alkaline; gradual smooth boundary.

C—52 to 65 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; massive; very hard, very firm, sticky and plastic; few concretions and soft bodies of calcium carbonate; moderately alkaline.

Thickness of the solum ranges from 40 to 60 inches. These soils, when dry, have cracks 0.5 inch to 4 inches wide that form at the surface and extend to a depth of 20 inches or more. Intersecting slickensides begin 20 to 30 inches below the surface. The axes of the parallelepipeds are tilted 10 to 45 degrees from the horizontal. The 10- to 40-inch layer is clay or sandy; it is

40 to 60 percent clay. Reaction is mildly alkaline or moderately alkaline.

The A horizon is very dark gray or dark gray. The AC horizon is dark gray or gray. These horizons are clay or sandy clay.

The C horizon is grayish brown, light brownish gray, or pale brown. It is clay or sandy clay.

Willacy series

The Willacy series consists of deep, well drained, loamy soils on uplands. These soils formed in alkaline loamy sediments partly reworked by wind. Slopes range from 0 to 3 percent.

Typical pedon of Willacy fine sandy loam, 0 to 1 percent slopes, from the intersection of Farm Road 490 and Farm Road 493 in Hargill, 2.5 miles south on Farm Road 493, 1.5 mile east on Nitler Road, 0.3 mile south on county road, 0.1 mile east on field road, and 50 feet south, in a citrus orchard:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine pores; many fine roots; mildly alkaline; clear smooth boundary.

A1—7 to 14 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable; many fine pores; many fine roots; mildly alkaline; clear smooth boundary.

B21t—14 to 19 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, friable; many fine pores; few fine roots; few thin clay films on faces of peds; mildly alkaline; gradual smooth boundary.

B22t—19 to 42 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to weak fine subangular blocky; hard, friable; many fine pores; few thin clay films on faces of peds; mildly alkaline; gradual smooth boundary.

B3—42 to 59 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, friable; few films and threads of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

C—59 to 69 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; massive; hard, friable; few soft lumps and concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

Cca—69 to 80 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; massive; hard, friable; about 5 percent, by volume, soft lumps and concretions of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 40 to 59 inches. Depth to secondary carbonate ranges from 36 to 50 inches.

The A horizon is very dark grayish brown, dark grayish brown, or grayish brown. Reaction is neutral or mildly alkaline.

The Bt horizon is dark grayish brown, grayish brown, brown, or pale brown. It is sandy clay loam or fine sandy loam and has a clay content of 18 to 27 percent. Reaction is mildly alkaline or moderately alkaline. The B3 horizon is brown or pale brown. It is sandy clay loam or fine sandy loam.

The C horizon is pale brown or very pale brown. It is sandy clay loam or fine sandy loam.

Zalla series

The Zalla series consists of deep, somewhat excessively drained, sandy soils on bottom lands. These soils formed in thick beds of calcareous sandy alluvium. Slope ranges from 0 to 3 percent.

Typical pedon of Zalla loamy fine sand, undulating, from the intersection of Texas Highway 115 and U.S. Highway 281 in Hidalgo, 1.2 miles south on U.S. Highway 281, 1.4 miles west on field road, and 150 feet west of road:

A1—0 to 9 inches; light gray (10YR 7/2) loamy fine sand, grayish brown (10YR 5/2) moist; single grained; loose, very friable, nonsticky; common fine roots; calcareous; moderately alkaline; gradual smooth boundary.

C1—9 to 65 inches; very pale brown (10YR 7/3) fine sand, brown (10YR 5/3) moist; single grained; loose, very friable, nonsticky; weakly expressed bedding planes are evident; few brownish organic stains along root channels; thin strata of silt loam; few mica flakes; calcareous; moderately alkaline.

The texture in the uppermost 40 inches of the soil ranges from loamy fine sand to sand. Bedding planes are weakly expressed but evident. There are thin strata of contrasting textures, including very fine sandy loam, silt loam, and silty clay loam, throughout the soil.

The A horizon is light gray, brown, light brownish gray, pale brown, or very pale brown. It is loamy fine sand or silt loam. Strata that have texture finer than loamy fine sand have a combined thickness of less than 18 inches.

The C horizon is light brownish gray, pale brown, light gray, or very pale brown. The C horizon, to a depth of about 40 inches, ranges from fine sand to loamy fine sand and has thin strata of very fine sandy loam, silt loam, or silty clay loam. The sediment below a depth of 40 inches is stratified, and in places the strata range from fine sand to silty clay.

formation of the soils

In this section the factors of soil formation are discussed and related to the soils in Hidalgo County. In addition, the processes of soil formation are described.

factors of soil formation

Soil is formed by the action and interaction of the five major soil-forming factors—climate, living organisms (especially vegetation), relief, time, and parent material. The kind of soil that develops in a given area is determined by these conditions, although the effect of any one factor is sometimes difficult to isolate. The relation of parent material as a factor of formation is discussed in the section "Surface geology and parent material."

climate

Rainfall, temperature, humidity, and wind have been important in the formation of soils in Hidalgo County. The wet climate of past geologic ages influenced the deposition of alluvial parent materials, and later, as rainfall decreased, the soil was seldom wet below the root zone. As a result, horizons of calcium carbonate formed in many of the soils. Many of the soils are calcareous throughout the profile because of the lack of downward moving water. Annual rainfall in the county ranges from 20 inches in the western part to 24 inches in the eastern part (*13*). Soils in the eastern part generally have less lime in the surface layer and have more development in the lower horizons than do soils in the western part.

Wind has affected the formation of soils in the county. Many of the soils have been reworked and rearranged by the predominately southeasterly gulf winds. The sand sheet in northern Hidalgo County consists of eolian sediments, which overlie older sediments.

living organisms

Plants, animals, earthworms, insects, and micro-organisms are important in the formation of soils. The amount of organic matter, nitrogen, and other plant nutrients in the soil and changes in structure and porosity are among the effects of living organisms.

Vegetation, predominantly prairie grasses, affects soil formation in Hidalgo County more than any other biological modifier. The mid and tall prairie grasses contribute a large amount of organic matter to the soils. Roots decay and leave channels and pores that provide passageways for the intake of air and water.

Earthworms, insects, and burrowing animals mix soil materials and help the downward movement of air, water, and plant roots into the soil. Bacteria and fungi break down organic matter, which improves the fertility and tilth of soils.

The influence of man considerably affects the soils of this county. By tillage and the use of heavy machinery, he compacts some soils and reduces the aeration and infiltration of water. Many areas are considerably altered by land leveling, and in some areas the natural formations are completely destroyed. Man has increased the moisture supply by his use of irrigation, and in places he has installed drainage systems to make the land more productive.

relief

Relief or topography affects soil formation through its influence on drainage, erosion, and plant cover. The degree of development of a soil profile depends on the amount of water that enters the soil, provided other factors of soil formation are equal. Although Hidalgo County is on a nearly level deltaic plain where slope is generally less than 1 percent, there is enough relief for the formation of more developed, better drained soils. The less developed soils are in weakly concave depressions that receive extra water.

time

The characteristics of a soil are determined mainly by the length of time that the soil-forming factors have been active. Hundreds to thousands of years are usually required for the formation of well-defined, genetic horizons. Geologically, the soils of Hidalgo County range from very young to fairly old. Differences in the ages of these soils, however, can be noted in their profile. For example, the Rio Grande, Zalla, Camargo, Matamoros, and Grulla soils, which are on recent flood plains, consist of unaltered or slightly altered alluvial sediments. The more developed Delfina, Hargill, and Willacy soils, which formed in sediments of Pleistocene age, have been in place long enough to have some genetic horizons (*12*). They have lost free lime from the upper layers, and clay particles have been translocated from the surface layer into the subsoil.

soil horizon differences

This section contains a brief definition of the horizon nomenclature and processes responsible for horizon development.

In the soil profile, horizons, or successional layers, are formed from the surface down to parent material. The horizons differ in one or more properties such as thickness, color, texture, structure, consistence, porosity, and reaction.

Most profiles contain three major horizons. They are designated A, B, and C. In some young soils, a B horizon has not developed. Also, in other soils, a Ccam horizon or one of indurated calcium carbonate is present. Several processes are involved in the formation of these horizons. In Hidalgo County the main processes are accumulation of organic matter, leaching of calcium carbonate and bases, and formation and translocation of silicate clay minerals. In most soils more than one of these processes have been active in the development of horizons.

The A horizon is the surface layer. It can either be the horizon of maximum organic matter accumulation, called the A1, or the horizon of maximum leaching of materials, called the A2 (*16*). The soils of Hidalgo County range from low to high in organic matter content. Sarita soils have a thin A1 horizon that is low in organic matter and a thick A2 horizon. Racombes soils have a thick A1 horizon that is high in organic matter.

The B horizon lies immediately below the A horizon. It is either a horizon of maximum accumulation of materials such as iron oxides or clays that were translocated from overlying horizons or it may be a horizon that shows distinct development of structure but with little translocated materials. When a B horizon contains significant amounts of translocated clay, it is designated as a Bt horizon. The Bt horizon has more clay and generally is firmer in consistence than the horizons immediately above and below and commonly has blocky structure. Subsurface layers that have a distinct structure and have little or no translocated clay are designated just as a B horizon. Delfina and Hargill soils have a distinct Bt horizon; Hidalgo soils have a B horizon.

The C horizon is seldom affected by the soil-forming process, but it can be modified by weathering. The Delmita, Randado, and Cuevitas soils have a Ccam horizon.

surface geology and parent material

By Saul Aronow, professor, Department of Geology, Lamar University, Beaumont, Texas

Hidalgo County is in the West Gulf Coastal Plain section of the Coastal Plains province of the United States (*8*). The surface consists of sedimentary fluviatile and eolian deposits. The surface sedimentary rocks, mostly unlithified, dip gently Gulfward and range in age from Holocene, less than 5,000 years old, to Pliocene, between 2 and 5 million years old. The eolian sediments are Holocene and Pleistocene and range from less than 5,000 years to over 20,000 years.

The subsurface rocks are broken in places by north-south trending, coastward-dipping, normal faults whose downthrown sides are also towards the Gulf. The faults belong to an older Sam Fordyce-Vanderbilt System and a younger McAllen System (*9*). Many of the producing oil fields in Hidalgo County and adjacent counties are on structures associated with these fault systems. No known clearly defined faults manifest themselves at the surface either as scarps or lithologic discontinuities.

The geologic designations mainly follow the latest geologic map of the region (*22*). The soils described in this section refer to those on the general soil map. Some soils cannot be uniformly correlated with a specific geologic unit because the soils do not fully match with any of the available versions of the local geology (*5, 11, 22*). These differences bear directly upon the genesis of the soils.

One difference is that formation contacts are concealed beneath the great South Texas Sand Sheet in the northern part of the area. Wind action has blurred the older fluvial deposits by shifting and redistributing the surface materials. Most of the geologic landforms and soil areas of the county have a northwest-trending eolian "grain" or lineation. In places the lineation is the result of the movement by wind of such soil materials as sand and sand-sized silty and clayey aggregates, and in other places lineation is the product of elongate blowouts or wind-eroded hollows.

Other factors are the low rainfall and the high evaporation rate in the county. This combination leads to a retention of calcium carbonate within the soils and tends to enhance similarities among soils, despite differences in age.

With the exception of the surface of the recent alluvium of the Rio Grande, most of the county is randomly pitted with depressional areas, largely Tiocano and Rio soils. These depressional areas probably originated in several ways, which reduces their effectiveness as a "signature" of geologic units such as in some other Gulf Coast counties. In the eastern and northern parts of the county, most depressional areas seem to be the result of blowouts; in the western part, they are underlain by a cemented caliche "cap rock" and are possibly karstic (solutional) in origin.

Lastly, flooding of the Rio Grande, as controlled by manmade and natural floodway systems, has added post-Pleistocene sediments to both recent and older surfaces. These sediments have buried or modified some older soils and the geologic age distinctions.

The **Holocene alluvium of the Rio Grande** is the youngest parent material in the county. The Rio Grande-Matamoros and Harlingen-Runn-Reynosa general soil map units formed in these materials. The surface of the alluvium appears to be graded to the present-day sea

level, which has been stable for the past 3,000 to 5,000 years. The two soil units differ in age. The Rio Grande traverses the younger Rio Grande-Matamoros unit. The soils are on well-preserved crescentic point bars, levee ridges, crevasse splays, flood basins (or backswamps), and on filled meander cut-offs. By contrast, the older Harlingen-Runn-Reynosa unit is on a partly obliterated fluvial morphology. Much of the area east of the Mission inlet to the Main Floodway is lower than the most recent course of the Rio Grande and, in effect, serves as a flood basin. This area has been covered with a veneer of fairly uniform flood basin deposits. The difference in elevation between the two soil units is probably caused by compaction and settling of the clayey sediments that underlie the older unit.

The remnants of the older course of the Rio Grande are continuous with the Resaca de los Fresnos in Cameron County. It terminates in an abandoned Rio Grande delta complex north of the present mouth (see general soil map) (*21*).

The passage of floodwaters of the Rio Grande through the site of the North Floodway to the Gulf of Mexico probably occurred prehistorically in a manner similar to their passage through Arroyo Colorado south of Mercedes. The high level alluvial deposits of the Rio Grande were deposited by these floodwaters. The parent materials of Mercedes soils are probably the product of alluvium from this fairly recent but prehistoric flooding because these soils are mostly on Holocene and Pleistocene surfaces.

The **South Texas Sand Sheet** covers the northern part of the county. The Nueces-Sarita and the Delfina-Hebbronville-Comitas general soil map units are within this area. The Sand Sheet deposits overlie and conceal most of the northern parts of the Lissie and Goliad Formations. Most of the Sand Sheet exhibits the eolian lineation oriented to the northwest (*5*).

The sources of the sand in the Sand Sheet include a relict Pleistocene barrier island system along the western shores of Laguna Madre in Kenedy County; a sandy shoreline (now submerged) that was deposited when the sea level dropped during the Pleistocene ice advances; and the fluviatile deposits in Cameron and Hidalgo Counties (also of Pleistocene age). The northwest-trending eolian lineation of southern Hidalgo County continues into the Sand Sheet area, which functions as a trap, or area of accumulation, for sand transported toward the northwest.

The Sand Sheet within Hidalgo County consists of smooth sheet deposits, blowouts, and low, irregular, longitudinal, stabilized dunes. The dunes and blowouts were probably active during recent droughty periods as well as during the variable climate of the Pleistocene. In terms of transportation and deposition, the deposits of the Sand Sheet seem to span the Holocene and Pleistocene.

The upper, or fine sand, portions of the sola of the Delfina, Comitas, Nueces, Sarita, and Falfurrias soils (given in order of increasing sand thickness) are all, or part, eolian. The soils with a thinner sandy surface layer, (Delfina, Comitas, and other soils in the general area), if not completely eolian in orgin, probably had sandy eolian increments during formation.

Clay dunes, somewhat inaccurately named, are aerially arcuate to irregularly shaped accumulations of silt, clay, and sand on the leeward sides of intermittently dry ponds and small lakes of blowout origin. These blowouts have penetrated through the sand cover into the underlying clayey, silty, or loamy sediments.

The blowouts retain rainwater because of the relative impermeability of the soils or a high water table. When dry, the laminated silty and clayey sediments lining the bottoms crack and yield sand-sized silty and clayey aggregates. These are blown out and accumulate as clay dunes on the leeward sides of the blowouts.

The **Beaumont Formation** of the Pleistocene is the next oldest geologic unit in the county. It outcrops from the western edge of the Mississippi River flood plain along the Gulf coast in Louisiana and Texas and into the eastern edge of Hidalgo County.

The general soil map units along the eastern edge of the county (the Raymondville-Mercedes, the Willacy-Racombes, and parts of the Raymondville-Hidalgo units east of the North Floodway) formed on the Beaumont Formation. Some narrow terraces—south of McAllen, Pharr, and Mission and bordering the recent alluvium—are probably part of the Beaumont Formation and lie within the Hidalgo unit.

The Beaumont Formation is largely of fluviatile origin. Toward the western edge of Cameron County and extending into Hidalgo County, relict fluvial patterns are increasingly replaced by the pervasive northwest-trending eolian lineation.

The age of the Beaumont Formation is uncertain because it is beyond the range of current radio-carbon dating (greater than 40,000 years).

The **Lissie Formation**, the Pleistocene unit below the Beaumont Formation stratigraphically, makes up the parent material for the Hidalgo and Willacy-Racombes units. The northern part of the outcrop area of the Lissie Formation is concealed beneath the South Texas Sand Sheet. Like the Beaumont Formation, the Lissie Formation is probably fluviatile in origin and was laid down during an interglacial time. Most of the Lissie surface carries the northwest-trending eolian lineation.

The **Goliad Formation**, the oldest geologic unit, is Pliocene in age and underlies the McAllen-Brennan, Brennan-Hidalgo, Delmita-Randado, Pits-Jimenez-Quemado, and Willacy-Delfina-Hargill units. The surfaces of these units also have some degree of the northwest-trending eolian lineation.

The soils overlying the Goliad Formation may have no direct relationship to Goliad. For example, the soils of the Brennan-Hidalgo unit seem to have formed in younger, wind-deposited sediments than the caliche, sand, and gravel of the Goliad Formation.

The Goliad Formation, as seen in excavations and described in oil well records, is overlain, or capped in most places with many feet of caliche (*7*). The deposits of sand and gravel (most are caliche-cemented) that underlie the Pits-Jimenez-Quemado unit are in a coarser phase of the formation. Much of the coarse material, where exposed, displays bedding (including considerable cross-bedding) of fluvial or alluvial fan origin.

The origin of the thick calcium carbonate in the thick caliche mantle on the Goliad Formation is not clearly understood. Most of it was transported to this formation as a component of eolian sediments. It was subsequently translocated into the upper part of this formation (*4*).

Much of the surface of the Goliad Formation shows a fracture-controlled karstic or solutional pattern with many undrained depressional areas. This suggests, at least locally, that the rate of caliche accumulation is less than the solution rate (*3, 10*).

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glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Medium	6 to 9
High	9 to 12
Very high	More than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Delta. An alluvial deposit, commonly triangular in shape, formed largely beneath water and deposited at the mouth of a river or stream.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods

during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess alkali (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluviate. Sediments produced by the action of a river or stream.

Forb. Any herbaceous plant not a grass or a sedge.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only

after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the

soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Lineation. Any linear structure in a rock or linear arrangement of components in sediments.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Microrelief. Minor surface configurations of the land, such as low mounds and shallow depressions.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Montmorillonite. A fine, platy, allumino-silicate clay mineral that expands and contracts with absorption and loss of water. It has a high cation-exchange capacity and is plastic and sticky when wet.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Open space. A relatively undeveloped green or wooded area provided mainly within an urban area to minimize feelings of congested living.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parallelepipeds. A six-sided prism whose faces are parallelograms.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Scarp. A line of cliffs produced by faulting or erosion.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can

damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium absorption ratio (SAR) of a saturation extract, or the ratio of Na^+ to $Ca^{++} + Mg^{++}$. The degrees of sodicity are—

	SAR
Slight	Less than 13:1
Moderate	13-30:1
Strong	More than 30:1

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from

4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded 1951-75 at McAllen, Texas]

Month	Temperature: Average daily maximum	Temperature: Average daily minimum	Temperature: Average daily	Temperature: 2 years in 10 will have-- Maximum temperature higher than--	Temperature: 2 years in 10 will have-- Minimum temperature lower than--	Temperature: Average number of growing degree days[1]	Precipitation: Average	Precipitation: 2 years in 10 will have-- Less than--	Precipitation: 2 years in 10 will have-- More than--	Precipitation: Average number of days with 0.10 inch or more	Precipitation: Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	70.6	48.2	59.4	91	27	329	1.21	.17	1.97	2	.0
February---	74.0	50.6	62.3	94	28	356	1.11	.21	1.81	3	.0
March------	80.1	57.2	68.7	98	36	580	.73	.05	1.21	2	.0
April------	86.4	65.1	75.8	101	47	774	1.50	.19	2.46	2	.0
May--------	89.7	69.3	79.6	100	55	918	2.17	.50	3.48	3	.0
June-------	93.0	72.8	82.9	99	64	987	3.04	.54	4.95	4	.0
July-------	95.0	73.4	84.2	101	68	1,060	1.46	.09	2.47	2	.0
August-----	96.2	73.7	85.0	101	67	1,085	1.85	.18	3.04	3	.0
September--	92.6	71.0	81.8	101	58	954	4.33	.99	6.94	5	.0
October----	86.6	63.7	75.2	97	46	781	3.19	.81	5.10	4	.0
November---	78.0	55.5	66.8	93	33	504	1.01	.14	1.67	3	.0
December---	72.3	49.7	61.1	90	30	356	.93	.10	1.54	2	.0
Yearly:											
Average--	84.5	62.5	73.6	---	---	---	---	---	---	---	---
Extreme--	---	---	---	104	26	---	---	---	---	---	---
Total----	---	---	---	---	---	8,684	22.53	14.34	29.91	35	.0

[1] A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded 1951-75 at McAllen, Texas]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	*	February 4	March 1
2 years in 10 later than--	*	January 22	February 16
5 years in 10 later than--	*	December 6	January 22
First freezing temperature in fall:			
1 year in 10 earlier than--	*	December 17	November 20
2 years in 10 earlier than--	*	December 30	December 1
5 years in 10 earlier than--	*	*	December 23

*Probability of occurrence of threshold temperature is less than indicated probability.

TABLE 3.--GROWING SEASON

[Recorded 1951-75 at McAllen, Texas]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	>365	325	282
8 years in 10	>365	>365	298
5 years in 10	>365	>365	330
2 years in 10	>365	>365	>365
1 year in 10	>365	>365	>365

TABLE 4.--POTENTIALS AND LIMITATIONS OF MAP UNITS ON THE GENERAL SOIL MAP

Map Unit	Percent of area	Cropland		Citrus	Vegetables	Rangeland	Urban uses
		Nonirrigated	Irrigated				
1. Hidalgo	18	High	High	High	High	High	Medium: shrink-swell.
2. McAllen-Brennan	12	Medium: droughty.	High	High	High	High	Medium: shrink-swell.
3. Brennan-Hidalgo	11	Medium: droughty.	High	High	High	High	Medium: shrink-swell.
4. Willacy-Delfina-Hargill	8	High	High	High	High	High	Medium: shrink-swell.
5. Delmita-Randado	8	Low: droughty, rooting depth.	Medium: rooting depth.	Low: rooting depth.	Medium: rooting depth.	Medium: droughty.	Medium: cemented pan.
6. Willacy-Racombes	2	High	High	High	High	High	Medium: floods.
7. Nueces-Sarita	15	Low: droughty.	Medium: fast intake.	Low: fast intake.	Low: fast intake.	Medium: droughty.	Low: too sandy, low strength.
8. Delfina-Hebbronville-Comitas	7	Low: droughty.	Medium: fast intake.	Medium: fast intake.	Medium: fast intake.	Medium: droughty.	Medium: low strength, too sandy.
9. Harlingen-Runn-Reynosa	9	Medium: slow intake.	High	Low: too clayey.	Medium: slow intake.	High	Low: shrink-swell, percs slowly.
10. Raymondville-Mercedes	4	Medium: slow intake.	High	Low: too clayey.	Medium: slow intake.	Medium: droughty.	Low: shrink-swell, percs slowly.
11. Raymondville-Hidalgo	2	Medium: slow intake.	High	Low: too clayey.	Medium: slow intake.	Medium: droughty.	Low: shrink-swell.
12. Rio Grande-Matamoros	3	Medium: droughty, slow intake.	High	Low: floods.	High	High	Low: floods.
13. Pits-Jimenez-Quemado	1	Unsuited: droughty, rooting depth.	Unsuited: rooting depth.	Unsuited: rooting depth.	Unsuited: rooting depth.	Low: droughty.	Low: cemented pan.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Arents, loamy	347	*
2	Benito clay	1,367	0.1
3	Brennan fine sandy loam, 0 to 1 percent slopes	89,456	9.0
4	Brennan fine sandy loam, 1 to 3 percent slopes	16,223	1.6
5	Camargo silt loam	1,944	0.2
6	Camargo silty clay loam	1,923	0.2
7	Cameron silty clay	2,188	0.2
8	Comitas loamy fine sand, 0 to 3 percent slopes	13,994	1.4
9	Delfina loamy fine sand, 0 to 3 percent slopes	28,496	2.9
10	Delfina fine sandy loam, 0 to 1 percent slopes	13,885	1.4
11	Delfina fine sandy loam, 1 to 3 percent slopes	1,290	0.1
12	Delmita loamy fine sand, 0 to 3 percent slopes	14,852	1.5
13	Delmita-Randado complex, 0 to 1 percent slopes	53,360	5.4
14	Falfurrias fine sand, 0 to 5 percent slopes	2,543	0.3
15	Grulla clay	2,274	0.2
16	Hargill fine sandy loam, 0 to 1 percent slopes	8,271	0.8
17	Hargill fine sandy loam, 1 to 3 percent slopes	5,860	0.6
18	Hargill fine sandy loam, 3 to 5 percent slopes	664	0.1
19	Harlingen clay	45,131	4.5
20	Harlingen clay, saline	4,916	0.5
21	Harlingen-Urban land complex	707	0.1
22	Hebbronville sandy loam, 0 to 1 percent slopes	24,197	2.4
23	Hebbronville sandy loam, 1 to 3 percent slopes	5,902	0.6
24	Hebbronville sandy loam, 3 to 5 percent slopes	1,380	0.1
25	Hidalgo fine sandy loam, 0 to 1 percent slopes	60,373	6.1
26	Hidalgo fine sandy loam, 1 to 3 percent slopes	8,384	0.8
27	Hidalgo fine sandy loam, 3 to 5 percent slopes	1,572	0.2
28	Hidalgo sandy clay loam, 0 to 1 percent slopes	141,601	14.2
29	Hidalgo sandy clay loam, 1 to 3 percent slopes	1,160	0.1
30	Hidalgo sandy clay loam, saline, 0 to 1 percent slopes	1,978	0.2
31	Hidalgo-Urban land complex, 0 to 3 percent slopes	11,895	1.2
32	Jimenez-Quemado complex, 1 to 8 percent slopes	1,238	0.1
33	Laredo silty clay loam	1,663	0.2
34	Matamoros silty clay	6,561	0.7
35	McAllen fine sandy loam, 0 to 1 percent slopes	55,514	5.6
36	McAllen fine sandy loam, 1 to 3 percent slopes	9,329	0.9
37	McAllen fine sandy loam, 3 to 5 percent slopes	1,365	0.1
38	McAllen sandy clay loam, 0 to 1 percent slopes	1,748	0.2
39	Mercedes clay, 0 to 1 percent slopes	10,093	1.0
40	Mercedes clay, saline, 0 to 1 percent slopes	668	0.1
41	Mercedes clay, 1 to 5 percent slopes, gullied	330	*
42	Nueces fine sand, 0 to 3 percent slopes	63,078	6.3
43	Nueces-Sarita complex, 0 to 3 percent slopes	60,349	6.1
44	Olmito silty clay	1,274	0.1
45	Pits, borrow	286	*
46	Pits, caliche	2,171	0.2
47	Pits, gravel	1,803	0.2
48	Racombes sandy clay loam	12,341	1.2
49	Racombes sandy clay loam, saline	577	0.1
50	Ramadero sandy clay loam	9,604	1.0
51	Randado-Cuevitas complex, 0 to 3 percent slopes	14,309	1.4
52	Raymondville clay loam	41,158	4.1
53	Raymondville clay loam, saline	1,348	0.1
54	Raymondville-Urban land complex	3,832	0.4
55	Reynosa silty clay loam	8,841	0.9
56	Reynosa silty clay loam, saline	722	0.1
57	Reynosa-Urban land complex	215	*
58	Rio fine sandy loam	1,193	0.1
59	Rio fine sandy loam, saline	953	0.1
60	Rio clay loam	8,101	0.8
61	Rio clay loam, saline	258	*
62	Rio Grande silt loam	7,628	0.8
63	Rio Grande silty clay loam	3,782	0.4
64	Runn silty clay	21,428	2.2
65	Runn silty clay, saline	2,635	0.3
66	Sarita fine sand, 0 to 3 percent slopes	15,924	1.6
67	Tiocano clay	1,591	0.2
68	Urban land	1,095	0.1
69	Ustorthents, loamy	747	0.1

See footnote at end of table.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--*Continued*

Map symbol	Soil name	Acres	Percent
70	Willacy fine sandy loam, 0 to 1 percent slopes	30,600	3.1
71	Willacy fine sandy loam, 1 to 3 percent slopes	9,872	1.0
72	Willacy-Urban land complex, 0 to 3 percent slopes	297	*
73	Zalla loamy fine sand, undulating	1,896	0.2
74	Zalla silt loam	970	0.1
	Water	7,680	0.8
	Total	995,200	100.0

* Less than 0.1 percent.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Map symbol and soil name	Cotton lint		Grain sorghum		Oranges		Grapefruit		Onions		Pasture	
	N	I	N	I	N	I	N	I	N	I	N	I
	Lb	Lb	Bu	Bu	Box	Box	Box	Box	Sack	Sack	AUM*	AUM*
1.** Arents												
2 Benito	150	250	---	35	---	---	---	---	---	---	2	3.5
3 Brennan	250	1,100	45	110	---	225	---	325	---	---	3	14
4 Brennan	200	1,000	40	90	---	225	---	325	---	---	3	14
5, 6 Camargo	---	1,100	---	130	---	---	---	---	---	425	---	14
7 Cameron	---	1,000	---	105	---	---	---	---	---	350	---	12
8 Comitas	---	---	25	80	---	---	---	---	---	---	2	8
9 Delfina	175	700	28	75	---	---	---	---	---	---	2	8
10 Delfina	375	900	50	100	---	200	---	300	---	---	3	12
11 Delfina	250	800	35	80	---	200	---	300	---	---	3	12
12 Delmita	175	750	25	80	---	---	---	---	---	---	2	8
13 Delmita-Randado	250	850	35	110	---	---	---	---	---	---	3	10
14 Falfurrias	---	---	---	---	---	---	---	---	---	---	---	---
15 Grulla	---	375	---	50	---	---	---	---	---	---	---	---
16 Hargill	375	1,100	50	115	---	270	---	375	---	---	4	15
17 Hargill	350	900	45	90	---	270	---	375	---	---	4	15
18 Hargill	---	---	35	65	---	---	---	---	---	---	3	10
19 Harlingen	300	1,100	40	125	---	---	---	---	---	375	5	13
20 Harlingen	150	300	---	30	---	---	---	---	---	---	3	6
21 Harlingen-Urban land	---	---	---	---	---	---	---	---	---	---	---	---
22 Hebbronville	---	---	50	90	---	---	---	---	---	---	3	15
23 Hebbronville	---	---	45	85	---	---	---	---	---	---	3	15

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Cotton lint		Grain sorghum		Oranges		Grapefruit		Onions		Pasture	
	N	I	N	I	N	I	N	I	N	I	N	I
	Lb	Lb	Bu	Bu	Box	Box	Box	Box	Sack	Sack	AUM*	AUM*
24 Hebbronville	---	---	40	80	---	---	---	---	---	---	2	10
25 Hidalgo	450	1,200	65	130	---	270	---	375	---	450	7	14
26 Hidalgo	380	950	45	110	---	270	---	375	---	320	6	14
27 Hidalgo	300	---	30	80	---	---	---	---	---	---	5	10
28 Hidalgo	450	1,200	65	130	---	270	---	375	---	450	7	14
29 Hidalgo	380	950	45	110	---	270	---	375	---	320	6	14
30 Hidalgo	150	250	---	25	---	---	---	---	---	---	2.0	8.0
31 Hidalgo-Urban land	---	---	---	---	---	---	---	---	---	---	---	---
32 Jimenez-Quemado	---	---	---	---	---	---	---	---	---	---	---	---
33 Laredo	450	1,200	60	130	---	270	---	375	---	450	7	18
34 Matamoros	---	1,000	45	105	---	---	---	---	---	405	---	---
35 McAllen	250	1,000	40	100	---	---	---	---	---	415	5	14
36 McAllen	200	900	35	90	---	---	---	---	---	415	5	12
37 McAllen	175	750	30	70	---	---	---	---	---	---	3	10
38 McAllen	250	1,000	40	100	---	---	---	---	---	415	5	14
39 Mercedes	300	1,100	45	126	---	---	---	---	---	375	6	14
40 Mercedes	150	300	---	30	---	---	---	---	---	---	3	6
41 Mercedes	---	---	---	---	---	---	---	---	---	---	5	12
42 Nueces	---	---	---	---	---	---	---	---	---	---	3	10
43 Nueces-Sarita	---	---	---	---	---	---	---	---	---	---	---	---
44 Olmito	425	900	50	105	---	---	---	---	---	350	5	12
45,** 46,** 47.** Pits												
48 Racombes	500	1,000	65	135	---	220	---	325	---	---	8	14

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Cotton lint		Grain sorghum		Oranges		Grapefruit		Onions		Pasture	
	N	I	N	I	N	I	N	I	N	I	N	I
	Lb	Lb	Bu	Bu	Box	Box	Box	Box	Sack	Sack	AUM*	AUM*
49. Racombes	150	250	---	35	---	---	---	---	---	---	2	8
50. Ramadero	500	1,000	60	135	---	---	---	---	---	---	8	12
51. Randado-Cuevitas	---	---	---	---	---	---	---	---	---	---	---	---
52. Raymondville	375	900	45	105	---	---	---	---	---	350	5	12
53. Raymondville	150	250	---	35	---	---	---	---	---	---	2.0	8
54. Raymondville-Urban land	---	---	---	---	---	---	---	---	---	---	---	---
55. Reynosa	375	1,100	35	125	---	---	---	---	---	425	5.0	14
56. Reynosa	150	250	---	35	---	---	---	---	---	---	2	8
57. Reynosa-Urban land	---	---	---	---	---	---	---	---	---	---	---	---
58. Rio	240	725	40	80	---	---	---	---	---	300	4	10
59. Rio	150	200	---	30	---	---	---	---	---	---	---	8
60. Rio	240	725	40	80	---	---	---	---	---	300	4	10
61. Rio	150	200	---	30	---	---	---	---	---	---	---	8
62, 63. Rio Grande	---	1,100	35	125	---	---	---	---	---	425	6	14
64. Runn	375	900	45	105	---	---	---	---	---	400	5	12
65. Runn	150	250	---	35	---	---	---	---	---	---	2	7.0
66. Sarita	---	---	---	---	---	---	---	---	---	---	---	---
67. Tiocano	---	---	---	---	---	---	---	---	---	---	4.0	---
68.** Urban land												
69.** Ustorthents												
70. Willacy	500	1,200	70	135	---	310	---	380	---	450	4	18
71. Willacy	425	950	60	105	---	310	---	380	---	400	4	18
72. Willacy-Urban land	---	---	---	---	---	---	---	---	---	---	---	---

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Cotton lint		Grain sorghum		Oranges		Grapefruit		Onions		Pasture	
	N	I	N	I	N	I	N	I	N	I	N	I
	Lb	Lb	Bu	Bu	Box	Box	Box	Box	Sack	Sack	AUM*	AUM*
73----------------------- Zalla	---	---	---	---	---	---	---	---	---	---	2	10
74----------------------- Zalla	---	---	20	40	---	---	---	---	---	---	4	15

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.
** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

[All soils are assigned to nonirrigated capability subclasses (N). Only potentially irrigable soils are assigned to irrigated subclasses (I). Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I (N)	---	---	---	---	---
(I)	437,541	---	---	---	---
II (N)	375,882	25,276	21,604	86,494	242,508
(I)	220,166	58,020	36,177	125,969	---
III (N)	347,891	34,980	9,294	55,224	248,393
(I)	267,909	201,674	9,294	56,941	---
IV (N)	217,663	199,438	4,170	14,055	---
(I)	19,591	---	5,537	14,054	---
V (N)	---	---	---	---	---
VI (N)	17,593	330	1,591	15,672	---
VII (N)	3,781	2,543	---	1,238	---
VIII(N)	---	---	---	---	---

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Map symbol and soil name	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Compo-sition
			Lb/acre		Pct
2 Benito	Salty Prairie	Favorable	4,500	Gulf cordgrass	50
		Normal	2,500	Alkali sacaton	10
		Unfavorable	1,000	Switchgrass	10
				Fourflower trichloris	5
				Vine-mesquite	5
				Buffalograss	5
				White tridens	5
				Silver bluestem	5
3, 4 Brennan	Sandy Loam	Favorable	4,500	Tanglehead	10
		Normal	3,600	Twoflower trichloris	10
		Unfavorable	2,200	Fourflower trichloris	10
				Arizona cottontop	10
				Pinhole bluestem	10
				Plains bristlegrass	10
				Hooded windmillgrass	10
				Pink pappusgrass	10
5, 6 Camargo	Loamy Bottomland	Favorable	7,000	Fourflower trichloris	15
		Normal	5,000	Little bluestem	15
		Unfavorable	3,000	Switchgrass	10
				Texas needlegrass	10
				Vine-mesquite	10
				White tridens	5
				Plains bristlegrass	5
				Buffalograss	5
				Pink pappusgrass	5
				Texas ebony	5
				Hackberry	5
7 Cameron	Clayey Bottomland	Favorable	8,000	Little bluestem	10
		Normal	6,500	Switchgrass	10
		Unfavorable	4,500	Fourflower trichloris	10
				Indiangrass	10
				Vine-mesquite	10
				Southwestern bristlegrass	8
				Buffalograss	8
				White tridens	8
8 Comitas	Loamy Sand	Favorable	4,000	Little bluestem	20
		Normal	3,000	Crinkleawn	10
		Unfavorable	2,000	Tanglehead	10
				Arizona cottontop	10
				Plains bristlegrass	10
				Switchgrass	5
				Sideoats grama	5
				Hooded windmillgrass	5
				Fall witchgrass	5
				Pink pappusgrass	5
9 Delfina	Loamy Sand	Favorable	4,000	Little bluestem	40
		Normal	3,000	Tanglehead	10
		Unfavorable	2,000	Plains bristlegrass	10
				Arizona cottontop	5
				Sideoats grama	5
				Hooded windmillgrass	5
				Pink pappusgrass	5

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Map symbol and soil name	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
10, 11: Delfina	Tight Sandy Loam	Favorable	4,500	Twoflower trichloris	10
		Normal	3,600	Fourflower trichloris	10
		Unfavorable	2,500	Plains bristlegrass	10
				Arizona cottontop	10
				Sideoats grama	8
				Hooded windmillgrass	7
				Pink pappusgrass	7
				Buffalograss	7
				Plains lovegrass	7
				Tanglehead	7
				Fringeleaf paspalum	5
12: Delmita	Loamy Sand	Favorable	3,500	Arizona cottontop	10
		Normal	2,600	Plains bristlegrass	10
		Unfavorable	1,500	Tanglehead	15
				Purple threeawn	5
				Fringeleaf paspalum	5
				Slim tridens	5
				Hooded windmillgrass	5
13:*					
Delmita	Red Sandy Loam	Favorable	4,000	Arizona cottontop	15
		Normal	3,000	Tanglehead	15
		Unfavorable	1,500	Plains bristlegrass	15
				Hooded windmillgrass	10
				Purple threeawn	5
				Fringeleaf paspalum	5
				Slim tridens	5
Randado	Shallow Sandy Loam	Favorable	3,500	Silver bluestem	13
		Normal	2,500	Tanglehead	13
		Unfavorable	1,000	Arizona cottontop	12
				Plains bristlegrass	12
				Hooded windmillgrass	12
				Fall witchgrass	9
				Slim tridens	8
				Sand dropseed	6
14: Falfurrias	Sandy Hill	Favorable	3,500	Seacoast bluestem	30
		Normal	2,500	Indiangrass	10
		Unfavorable	1,500	Crinkleawn	10
				Brownseed paspalum	10
				Wright threeawn	5
15: Grulla	Clayey Bottomland	Favorable	6,000	Little bluestem	10
		Normal	5,000	Switchgrass	10
		Unfavorable	4,000	Fourflower trichloris	10
				Giant sacaton	10
				Indiangrass	10
				Plains bristlegrass	7
				Vine-mesquite	7
16, 17, 18: Hargill	Sandy Loam	Favorable	5,500	Tanglehead	15
		Normal	4,000	Fourflower trichloris	15
		Unfavorable	2,200	Arizona cottontop	10
				Silver bluestem	10
				Plains bristlegrass	10
				Hooded windmillgrass	10
				Pink pappusgrass	10
				Slim tridens	10
19: Harlingen	Clayey Bottomland	Favorable	8,000	Southwestern bristlegrass	12
		Normal	6,500	Big sandbur	12
		Unfavorable	4,500	Fourflower trichloris	10
				Alkali sacaton	10
				Little bluestem	7
				Vine-mesquite	7
				Buffalograss	7

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Map symbol and soil name	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
22, 23, 24 Hebbronville	Sandy Loam	Favorable	4,500	Fourflower trichloris	10
		Normal	3,500	Twoflower trichloris	10
		Unfavorable	2,000	Tanglehead	10
				Arizona cottontop	10
				Plains bristlegrass	10
				Hooded windmillgrass	10
				Pink pappusgrass	10
				Whiplash pappusgrass	10
25, 26, 27, 28, 29 Hidalgo	Gray Sandy Loam	Favorable	4,500	Twoflower trichloris	10
		Normal	3,600	Fourflower trichloris	10
		Unfavorable	2,500	Plains bristlegrass	10
				Hooded windmillgrass	10
				Pink pappusgrass	10
				Lovegrass tridens	8
				Green sprangletop	7
				Slim tridens	5
				Buffalograss	5
				Arizona cottontop	5
				Plains lovegrass	5
				Whitebrush	5
				Lime pricklyash	5
32:*					
Jimenez	Gravelly Ridge	Favorable	3,000	Tanglehead	15
		Normal	2,000	Arizona cottontop	10
		Unfavorable	1,000	Pinhole bluestem	10
				Sideoats grama	10
				Green sprangletop	5
				Texas bristlegrass	5
Quemado	Gravelly Ridge	Favorable	2,200	Pinhole bluestem	10
		Normal	1,600	Pink pappusgrass	10
		Unfavorable	1,000	Tanglehead	10
				Sideoats grama	10
				Arizona cottontop	10
				Lovegrass tridens	5
				Hooded windmillgrass	5
				Plains bristlegrass	5
				Twoflower trichloris	5
				Fourflower trichloris	5
33 Laredo	Loamy Bottomland	Favorable	7,000	Fourflower trichloris	15
		Normal	5,000	Little bluestem	15
		Unfavorable	3,000	Southwestern bristlegrass	10
				Wright threeawn	5
				Plains bristlegrass	5
				Vine-mesquite	5
				Giant sacaton	5
				Switchgrass	5
				Big sandbur	5
34 Matamoros	Clayey Bottomland	Favorable	8,000	Vine-mesquite	10
		Normal	6,500	Buffalograss	10
		Unfavorable	4,500	Fourflower trichloris	9
				Indiangrass	9
				Giant sacaton	9
				Switchgrass	9
				Southwestern bristlegrass	6
				Virginia wildrye	6
				Rustyseed paspalum	6
				Big sandbur	6
35, 36, 37, 38 McAllen	Gray Sandy Loam	Favorable	4,500	Plains bristlegrass	20
		Normal	3,600	Hooded windmillgrass	10
		Unfavorable	2,500	Pink pappusgrass	10
				Arizona cottontop	10
				Twoflower trichloris	10
				Tanglehead	7
				Fall witchgrass	5
				Pinhole bluestem	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Map symbol and soil name	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
39: Mercedes	Clay Flat	Favorable	5,000	Twoflower trichloris	15
		Normal	3,500	Fourflower trichloris	15
		Unfavorable	2,000	Arizona cottontop	10
				Pink pappusgrass	10
				Vine-mesquite	10
				Silver bluestem	10
				Alkali sacaton	5
				Plains bristlegrass	5
				White tridens	5
42: Nueces	Sandy	Favorable	4,400	Seacoast bluestem	50
		Normal	3,400	Brownseed paspalum	10
		Unfavorable	2,000	Indiangrass	10
				Switchgrass	5
				Tanglehead	5
				Fringeleaf paspalum	5
				Hooded windmillgrass	5
43:*					
Nueces	Sandy	Favorable	4,400	Seacoast bluestem	50
		Normal	3,400	Brownseed paspalum	10
		Unfavorable	2,000	Indiangrass	10
				Switchgrass	5
				Tanglehead	5
				Fringeleaf paspalum	5
				Hooded windmillgrass	5
Sarita	Sandy	Favorable	4,000	Seacoast bluestem	50
		Normal	3,000	Brownseed paspalum	10
		Unfavorable	2,000	Indiangrass	10
				Switchgrass	5
				Tanglehead	5
				Fringeland paspalum	5
				Hooded windmillgrass	5
44: Olmito	Clayey Bottomland	Favorable	8,000	Twoflower trichloris	10
		Normal	6,500	Arizona cottontop	10
		Unfavorable	4,500	Switchgrass	10
				Giant sacaton	10
				Southwestern bristlegrass	7
				Vine-mesquite	7
				White tridens	7
				Buffalograss	7
				Curlymesquite	7
48: Racombes	Clay Loam	Favorable	6,000	Fourflower trichloris	40
		Normal	5,000	Arizona cottontop	10
		Unfavorable	2,500	Sideoats grama	10
				Lovegrass tridens	5
				Hooded windmillgrass	5
				Plains bristlegrass	5
				Buffalograss	5
				Vine-mesquite	5
				Pink pappusgrass	5
50: Ramadero	Ramadero	Favorable	6,000	Fourflower trichloris	40
		Normal	5,000	Arizona cottontop	10
		Unfavorable	2,500	Sideoats grama	10
				Pink pappusgrass	5
				Lovegrass tridens	5
				Hooded windmillgrass	5
				Plains bristlegrass	5
				Buffalograss	5
				Vine-mesquite	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Map symbol and soil name	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
51:*					
Randado	Shallow Sandy Loam	Favorable	3,500	Silver bluestem	13
		Normal	2,500	Tanglehead	13
		Unfavorable	1,000	Arizona cottontop	12
				Plains bristlegrass	12
				Hooded windmillgrass	12
				Fall witchgrass	9
				Slim tridens	8
				Sand dropseed	6
Cuevitas	Shallow Sandy Loam	Favorable	3,000	Silver bluestem	10
		Normal	2,000	Tanglehead	10
		Unfavorable	1,000	Arizona cottontop	10
				Plains bristlegrass	10
				Hooded windmillgrass	10
				Fall witchgrass	8
				Slim tridens	7
52 Raymondville	Clay Loam	Favorable	4,500	Fourflower trichloris	20
		Normal	3,500	Little bluestem	15
		Unfavorable	2,500	Pinhole bluestem	10
				Plains bristlegrass	10
				Pink pappusgrass	10
				Arizona cottontop	5
				Twoflower trichloris	5
				Buffalograss	5
				Curlymesquite	5
				Sideoats grama	5
55 Reynosa	Loamy Bottomland	Favorable	7,000	Twoflower trichloris	15
		Normal	5,500	Little bluestem	15
		Unfavorable	4,000	Texas needlegrass	10
				Vine-mesquite	10
				Big sandbur	5
				Switchgrass	5
58 Rio	Clay Loam	Favorable	4,500	Fourflower trichloris	15
		Normal	3,500	Little bluestem	10
		Unfavorable	2,500	Arizona cottontop	10
				Pink pappusgrass	10
				Vine-mesquite	10
				Plains bristlegrass	10
				Buffalograss	8
				Curlymesquite	7
				Pinhole bluestem	5
				Hooded windmillgrass	5
				Texas needlegrass	5
59 Rio	Salty Prairie	Favorable	3,500	Gulf cordgrass	25
		Normal	2,000	Alkali sacaton	25
		Unfavorable	750	Switchgrass	15
				Fourflower trichloris	10
				Vine-mesquite	10
				Buffalograss	10
60 Rio	Clay Loam	Favorable	4,500	Fourflower trichloris	15
		Normal	3,500	Little bluestem	10
		Unfavorable	2,500	Arizona cottontop	10
				Pink pappusgrass	10
				Vine-mesquite	10
				Plains bristlegrass	10
				Buffalograss	8
				Curlymesquite	7
				Pinhole bluestem	5
				Hooded windmillgrass	5
				Texas needlegrass	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Map symbol and soil name	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
61 Rio	Salty Prairie	Favorable	3,500	Gulf cordgrass	25
		Normal	2,000	Alkali sacaton	25
		Unfavorable	750	Switchgrass	15
				Twoflower trichloris	10
				Vine-mesquite	10
				Buffalograss	10
62, 63 Rio Grande	Loamy Bottomland	Favorable	7,000	Twoflower trichloris	15
		Normal	5,500	Little bluestem	15
		Unfavorable	4,000	Vine-mesquite	10
				Texas needlegrass	10
				Switchgrass	5
				Big sandbur	5
				White tridens	5
				Pink pappusgrass	5
64 Runn	Clayey Bottomland	Favorable	8,000	Southwestern bristlegrass	9
		Normal	6,000	Virginia wildrye	9
		Unfavorable	4,500	Big sandbur	9
				Giant sacaton	8
				Fourflower trichloris	8
				White tridens	8
				Vine-mesquite	8
				Switchgrass	8
66 Sarita	Sandy	Favorable	4,000	Seacoast bluestem	50
		Normal	3,000	Brownseed paspalum	10
		Unfavorable	2,000	Indiangrass	10
				Switchgrass	5
				Tanglehead	5
				Fringeleaf paspalum	5
				Hooded windmillgrass	5
67 Tiocano	Lakebed	Favorable	5,000	Hartweg paspalum	41
		Normal	4,000	Spike lovegrass	11
		Unfavorable	3,000	White tridens	11
				Switchgrass	11
				Buffalograss	6
				Curlymesquite	5
				Knotgrass	5
70, 71 Willacy	Sandy Loam	Favorable	5,400	Gray horsebrush	20
		Normal	4,500	Twoflower trichloris	15
		Unfavorable	3,000	Fourflower trichloris	15
				Little bluestem	10
				Hooded windmillgrass	10
73 Zalla	Vega	Favorable	4,000	Common reed	40
		Normal	3,000	Giant sacaton	25
		Unfavorable	2,000	White tridens	10
				Vine-mesquite	5
				Southwestern bristlegrass	5
74 Zalla	Loamy Bottomland	Favorable	4,000	Twoflower trichloris	15
		Normal	3,000	Little bluestem	15
		Unfavorable	2,000	Vine-mesquite	10
				Texas needlegrass	10
				Switchgrass	5
				Big sandbur	5
				White tridens	5
				Pink pappusgrass	5

*See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--PLANTS SUITABLE FOR GARDENING AND LANDSCAPING

[Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Flowers	Shrubs	Trees
1. Arents	Caladium, canna, marigold, petunia, periwinkle, zinnia.	Bougainvillaea, cenizo, copper leaf, croton, oleander, shrimp plant.	Anaqua, athel, Australian pine, Monterey cypress.
2. Benito			
3, 4. Brennan	Amaryllis, caladium, canna, chrysanthemum, day lily, marigold, petunia, periwinkle, snapdragon, sweetpea, zinnia.	Bougainvillaea, copper leaf, croton, duranta, firecracker bush, hibiscus, yellow jasmine, ligustrum, Natal plum, oleander, Pfitzer juniper, philodendron, pittosporum, blue plumbago, poinsettia, pyracantha, shrimp plant.	Anaqua, Rio Grande ash, athel, Australian pine, avocado, bottlebrush, Brazilian pepper, citrus, Chinese tallow, cottonwood, crepemyrtle, hackberry, Japanese yew, live oak, Norfolk Island pine, orchid tree, palm, Texas ebony, wild olive.
5, 6. Camargo	Amaryllis, caladium, canna, chrysanthemum, marigold, petunia, periwinkle, zinnia.	Bougainvillaea, cenizo, copper leaf, croton, duranta, esperanza, firecracker bush, yellow jasmine, oleander, poinsettia, shrimp plant.	Anaqua, Rio Grande ash, athel, Australian pine, bottlebrush, Brazilian pepper, cottonwood, desert willow, hackberry, Norfolk Island pine, palm, Texas ebony, wild olive.
7. Cameron	Amaryllis, caladium, canna, marigold, petunia, periwinkle, zinnia.	Bougainvillaea, cenizo, duranta, esperanza, oleander, pittosporum, shrimp plant.	Anaqua, Rio Grande ash, athel, Australian pine, bottlebrush, Brazilian pepper, cottonwood, hackberry, palm.
8. Comitas	Amaryllis, caladium, canna, chrysanthemum, day lily, marigold, petunia, periwinkle, snapdragon, sweetpea, zinnia.	Bougainvillaea, croton, duranta, esperanza, hibiscus, yellow jasmine, ligustrum, Natal plum, oleander, Pfitzer juniper, pittosporum, poinsettia, shrimp plant.	Anaqua, Rio Grande ash, athel, Australian pine, avocado, bottlebrush, Brazilian pepper, citrus, cottonwood, desert willow, live oak, orchid tree, palm, Texas ebony, wild olive.

TABLE 9.--PLANTS SUITABLE FOR GARDENING AND LANDSCAPING--Continued

Map symbol and soil name	Flowers	Shrubs	Trees
51----------------- Cuevitas	Caladium, canna, marigold, petunia, periwinkle, snapdragon, sweetpea, zinnia.	Cenizo, Natal plum, oleander, philodendron.	
9, 10, 11--------- Delfina	Amaryllis, caladium, canna, chrysanthemum, day lily, marigold, petunia, periwinkle, snapdragon, sweetpea, zinnia.	Bougainvillaea, croton, duranta, esperanza, hibiscus, yellow jasmine, ligustrum, Natal plum, oleander, Pfitzer juniper, pittosporum, poinsettia, shrimp plant.	Anaqua, Rio Grande ash, athel, Australian pine, avocado, bottlebrush, Brazilian pepper, citrus, cottonwood, desert willow, live oak, orchid tree, palm, Texas ebony, wild olive.
12, 13------------ Delmita	Amaryllis, caladium, canna, chrysanthemum, day lily, marigold, petunia, periwinkle, snapdragon, sweetpea, zinnia.	Bougainvillaea, cenizo, croton, duranta, esperanza, hibiscus, yellow jasmine, ligustrum, Natal plum, oleander, Pfitzer juniper, pittosporum, poinsettia, shrimp plant.	Athel, Australian pine, Brazilian pepper, Chinese tallow, palm, wild olive.
14---------------- Falfurrias	Amaryllis, caladium, canna, periwinkle, snapdragon, zinnia.	Bougainvillaea, cenizo, croton, duranta, esperanza, oleander, shrimp plant.	Anaqua, athel, Australian pine, bottlebrush, Brazilian pepper, desert willow.
15.* Grulla			
16, 17, 18-------- Hargill	Amaryllis, caladium, canna, chrysanthemum, day lily, marigold, petunia, periwinkle, snapdragon, sweetpea, zinnia.	Bougainvillaea, cenizo, copper leaf, croton, duranta, esperanza, firecracker bush, hibiscus, yellow jasmine, ligustrum, Natal plum, oleander, Pfitzer juniper, pittosporum, blue plumbago, poinsettia, pyracantha, shrimp plant.	Anaqua, Rio Grande ash, Australian pine, avocado, bottlebrush, Brazilian pepper, citrus, Chinese tallow, cottonwood, crepemyrtle, desert willow, hackberry, Japanese yew, orchid tree, palm, Texas ebony, wild olive.

See footnote at end of table.

TABLE 9.--PLANTS SUITABLE FOR GARDENING AND LANDSCAPING--Continued

Map symbol and soil name	Flowers	Shrubs	Trees
19, 21 Harlingen	Amaryllis, caladium, canna, marigold, petunia, periwinkle, zinnia.	Bougainvillaea, duranta, esperanza, oleander, pittosporum, shrimp plant.	Rio Grande ash, athel, Australian pine, Brazilian pepper, cottonwood, hackberry, palm.
20. Harlingen			
22, 23, 24 Hebbronville	Amaryllis, caladium, canna, chrysanthemum, day lily, marigold, petunia, periwinkle, snapdragon, sweetpea, zinnia.	Bougainvillaea, cenizo, copper leaf, croton, duranta, esperanza, firecracker bush, hibiscus, yellow jasmine, ligustrum, Natal plum, oleander, Pfitzer juniper, pittosporum, blue plumbago, poinsettia, pyracantha, shrimp plant.	Anaqua, Rio Grande ash, Australian pine, avocado, bottlebrush, Brazilian pepper, citrus, Chinese tallow, cottonwood, crepemyrtle, desert willow, hackberry, Japanese yew, orchid tree, palm, Texas ebony, wild olive.
25, 26, 27, 28, 29, 31 Hidalgo	Amaryllis, caladium, canna, chrysanthemum, marigold, petunia, periwinkle, zinnia.	Bougainvillaea, cenizo, copper leaf, croton, duranta, esperanza, firecracker bush, yellow jasmine, oleander, poinsettia, shrimp plant.	Anaqua, Rio Grande ash, athel, Australian pine, bottlebrush, Brazilian pepper, citrus, cottonwood, crepemyrtle, desert willow, hackberry, orchid tree, palm, Texas ebony, wild olive.
30. Hidalgo			
32 Jimenez	Caladium, marigold, petunia, periwinkle, zinnia.	Cenizo, netal-plum, oleander.	
33 Laredo	Amaryllis, caladium, canna, chrysanthemum, marigold, petunia, periwinkle, zinnia.	Bougainvillaea, cenizo, copper leaf, croton, duranta, esperanza, firecracker bush, yellow jasmine, oleander, poinsettia, shrimp plant.	Anaqua, Rio Grande ash, athel, Australian pine, bottlebrush, Brazilian pepper, citrus, cottonwood, crepemyrtle, desert willow, hackberry, orchid tree, palm, Texas ebony, wild olive.

TABLE 9.--PLANTS SUITABLE FOR GARDENING AND LANDSCAPING--Continued

Map symbol and soil name	Flowers	Shrubs	Trees
34----------------- Matamoros	Amaryllis, caladium, canna, marigold, petunia, periwinkle, zinnia.	Bougainvillaea, cenizo, duranta, esperanza, oleander, pittosporum, shrimp plant.	Anaqua, Rio Grande ash, athel, Australian pine, bottlebrush, Brazilian pepper, cottonwood, hackberry, palm.
35, 36, 37, 38---- McAllen	Amaryllis, caladium, canna, chrysanthemum, marigold, petunia, periwinkle, zinnia.	Bougainvillaea, cenizo, copper leaf, croton, duranta, esperanza, firecracker bush, yellow jasmine, oleander, poinsettia, shrimp plant.	Anaqua, Rio Grande ash, athel, Australian pine, bottlebrush, Brazilian pepper, citrus, cottonwood, crepemyrtle, desert willow, hackberry, orchid tree, palm, Texas ebony, wild olive.
39, 41------------ Mercedes	Amaryllis, caladium, canna, marigold, petunia, periwinkle, zinnia.	Bougainvillaea, duranta, esperanza, oleander, pittosporum, shrimp plant.	Rio Grande ash, athel, Australian pine, Brazilian pepper, cottonwood, hackberry, palm.
40. Mercedes			
42, 43------------ Nueces	Caladium, canna, periwinkle, snapdragon, zinnia.	Bougainvillaea, croton, esperanza, hibiscus, yellow jasmine, ligustrum, oleander, Pfitzer juniper, pittosporum, shrimp plant.	Athel, Australian pine, bottlebrush, Brazilian pepper, desert willow, palm.
44----------------- Olmito	Amaryllis, caladium, canna, marigold, petunia, periwinkle, zinnia.	Bougainvillaea, cenizo, duranta, esperanza, oleander, pittosporum, shrimp plant.	Anaqua, Rio Grande ash, athel, Australian pine, bottlebrush, Brazilian pepper, cottonwood, hackberry, palm.
45. Pits, borrow			
46. Pits, caliche			
47. Pits, gravel			
32----------------- Quemado	Caladium, marigold, petunia, periwinkle, zinnia.	Cenizo, Natal plum, oleander.	

TABLE 9.--PLANTS SUITABLE FOR GARDENING AND LANDSCAPING--Continued

Map symbol and soil name	Flowers	Shrubs	Trees
48 Racombes	Amaryllis, caladium, canna, chrysanthemum, day lily, marigold, petunia, periwinkle, snapdragon, sweetpea, zinnia.	Bougainvillaea, copper leaf, croton, duranta, firecracker bush, hibiscus, yellow jasmine, ligustrum, Natal plum, oleander, Pfitzer juniper, philodendron, pittosporum, blue plumbago, poinsettia, pyracantha, shrimp plant.	Anaqua, Rio Grande ash, athel, Australian pine, avocado, bottlebrush, Brazilian pepper, citrus, Chinese tallow, cottonwood, crepemyrtle, hackberry, Japanese yew, live oak, Norfolk Island pine, orchid tree, palm, Texas ebony, wild olive.
49. Racombes			
50 Ramadero	Amaryllis, caladium, canna, chrysanthemum, day lily, marigold, petunia, periwinkle, snapdragon, sweetpea, zinnia.	Bougainvillaea, copper leaf, croton, duranta, firecracker bush, hibiscus, yellow jasmine, ligustrum, Natal plum, oleander, Pfitzer juniper, philodendron, pittosporum, blue plumbago, poinsettia, pyracantha, shrimp plant.	Anaqua, Rio Grande ash, athel, Australian pine, avocado, bottlebrush, Brazilian pepper, Chinese tallow, cottonwood, crepemyrtle, hackberry, Japanese yew, live oak, Norfolk Island pine, Texas ebony, wild olive.
13, 51 Randado	Caladium, canna, marigold, petunia, periwinkle, snapdragon, sweetpea, zinnia.	Cenizo, Natal plum, oleander, philodendron.	Athel, Australian pine, Brazilian pepper, wild olive.
52, 54 Raymondville	Amaryllis, caladium, canna, marigold, petunia, periwinkle, zinnia.	Bougainvillaea, cenizo, duranta, esperanza, oleander, pittosporum, shrimp plant.	Anaqua, Rio Grande ash, athel, Australian pine, bottlebrush Brazilian pepper, cottonwood, hackberry, palm.
53. Raymondville			

TABLE 9.--PLANTS SUITABLE FOR GARDENING AND LANDSCAPING--Continued

Map symbol and soil name	Flowers	Shrubs	Trees
55, 57. Reynosa	Amaryllis, caladium, canna, chrysanthemum, marigold, petunia, periwinkle, zinnia.	Bougainvillaea, cenizo, copper leaf, croton, duranta, esperanza, firecracker bush, yellow jasmine, oleander, poinsettia, shrimp plant.	Anaqua, Rio Grande ash, athel, Australian pine, bottlebrush, Brazilian pepper, citrus, cottonwood, crepemyrtle, desert willow, hackberry, orchid tree, palm, Texas ebony, wild olive.
56. Reynosa			
58*, 59, 60*, 61. Rio			
62, 63. Rio Grande	Amaryllis, caladium, canna, chrysanthemum, marigold, petunia, periwinkle, zinnia.	Bougainvillaea, cenizo, copper leaf, croton, duranta, esperanza, firecracker bush, yellow jasmine, oleander, poinsettia, shrimp plant.	Anaqua, Rio Grande ash, athel, Australian pine, bottlebrush, Brazilian pepper, cottonwood, desert willow, hackberry, Norfolk Island pine, palm, Texas ebony, wild olive.
64. Runn	Amaryllis, caladium, canna, marigold, petunia, periwinkle, zinnia.	Bougainvillaea, cenizo, duranta, esperanza, oleander, pittosporum, shrimp plant.	Anaqua, Rio Grande ash, athel, Australian pine, bottlebrush, Brazilian pepper, cottonwood, hackberry, palm.
65. Runn			
43, 66. Sarita	Amaryllis, caladium, canna, periwinkle, snapdragon, zinnia.	Bougainvillaea, cenizo, croton, duranta, esperanza, oleander, shrimp plant.	Anaqua, athel, Australian pine, bottlebrush, Brazilian pepper, desert willow.
67.* Tiocano			
68. Urban land			
69. Ustorthents	Canna, marigold, periwinkle, zinnia.	Cenizo, copper leaf, croton, oleander.	Athel, Australian pine, Monterey cypress.

See footnote at end of table.

TABLE 9.--PLANTS SUITABLE FOR GARDENING AND LANDSCAPING--Continued

Map symbol and soil name	Flowers	Shrubs	Trees
70, 71, 72--------- Willacy	Amaryllis, caladium, canna, chrysanthemum, day lily, marigold, petunia, periwinkle, snapdragon, sweetpea, zinnia.	Bougainvillaea, cenizo, copper leaf, croton, duranta, esperanza, firecracker bush, hibiscus, yellow jasmine, ligustrum, Natal plum, oleander, Pfitzer juniper, pittosporum, blue plumbago, poinsettia, pyracantha, shrimp plant.	Anaqua, Rio Grande ash, Australian pine, avocado, bottlebrush, Brazilian pepper, citrus, Chinese tallow, cottonwood, crepemyrtle, desert willow, hackberry, Japanese yew, orchid tree, palm, Texas ebony, wild olive.
73, 74------------- Zalla	Amaryllis, caladium, canna, chrysanthemum, marigold, petunia, periwinkle, zinnia.	Bougainvillaea, cenizo, copper leaf, croton, duranta, esperanza, firecracker bush, yellow jasmine, oleander, poinsettia, shrimp plant.	Anaqua, Rio Grande ash, athel, Australian pine, bottlebrush, Brazilian pepper, cottonwood, desert willow, hackberry, Norfolk Island pine, palm, Texas ebony, wild olive.

* Soil not rated because plants are not suited. The soil remains wet for long periods of time.

TABLE 10.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1.* Arents					
2 Benito	Severe: floods, percs slowly, too clayey.	Severe: excess salt, percs slowly.	Severe: too clayey, percs slowly, excess salt.	Moderate: too clayey.	Severe: excess salt, too clayey.
3 Brennan	Slight	Slight	Slight	Slight	Slight.
4 Brennan	Slight	Slight	Moderate: slope.	Slight	Slight.
5 Camargo	Severe: floods.	Moderate: dusty.	Moderate: floods, dusty.	Severe: erodes easily.	Moderate: floods.
6 Camargo	Severe: floods.	Slight	Moderate: too clayey, floods.	Severe: erodes easily.	Moderate: floods.
7 Cameron	Moderate: too clayey.	Moderate: too clayey.	Severe: too clayey.	Moderate: too clayey.	Severe: too clayey.
8 Comitas	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: droughty.
9 Delfina	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Slight.
10 Delfina	Slight	Slight	Slight	Slight	Slight.
11 Delfina	Slight	Slight	Moderate: slope.	Slight	Slight.
12 Delmita	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: cemented pan.
13:* Delmita	Slight	Slight	Slight	Slight	Moderate: thin layer.
Randado	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Severe: thin layer.
14 Falfurrias	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
15 Grulla	Severe: floods, ponding, percs slowly.	Severe: floods, ponding, too clayey.	Severe: ponding, percs slowly, floods.	Severe: ponding, too clayey.	Severe: ponding, floods, too clayey.
16 Hargill	Slight	Slight	Slight	Slight	Slight.
17, 18 Hargill	Slight	Slight	Moderate: slope.	Slight	Slight.
19 Harlingen	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
20 Harlingen	Severe: excess salt.	Severe: excess salt.	Severe: percs slowly, too clayey, excess salt.	Moderate: too clayey.	Severe: excess salt, too clayey.
21:*					
Harlingen	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
Urban land.					
22 Hebbronville	Slight	Slight	Slight	Slight	Slight.
23, 24 Hebbronville	Slight	Slight	Moderate: slope.	Slight	Slight.
25 Hidalgo	Slight	Slight	Slight	Slight	Slight.
26, 27 Hidalgo	Slight	Slight	Moderate: slope.	Slight	Slight.
28 Hidalgo	Slight	Slight	Slight	Slight	Slight.
29 Hidalgo	Slight	Slight	Moderate: slope.	Slight	Slight.
30 Hidalgo	Severe: excess salt.	Severe: excess salt.	Severe: excess salt.	Slight	Severe: excess salt, droughty.
31:*					
Hidalgo	Slight	Slight	Slight	Slight	Slight.
Urban land.					
32:*					
Jimenez	Severe: small stones, cemented pan.	Severe: small stones, cemented pan.	Severe: small stones, cemented pan.	Severe: small stones.	Severe: small stones, thin layer.
Quemado	Severe: small stones, cemented pan.	Severe: small stones, cemented pan.	Severe: small stones, cemented pan.	Severe: small stones.	Severe: small stones, thin layer.
33 Laredo	Slight	Slight	Slight	Severe: erodes easily.	Slight.
34 Matamoros	Severe: floods.	Moderate: too clayey.	Moderate: too clayey, floods, dusty.	Moderate: too clayey.	Severe: too clayey.
35 McAllen	Slight	Slight	Slight	Slight	Slight.
36, 37 McAllen	Slight	Slight	Moderate: slope.	Slight	Slight.
38 McAllen	Slight	Slight	Slight	Slight	Slight.
39 Mercedes	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
40 Mercedes	Severe: excess salt.	Severe: excess salt.	Severe: too clayey, percs slowly, excess salt.	Moderate: too clayey.	Severe: excess salt, too clayey.
41 Mercedes	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: too clayey, percs slowly.	Moderate: slope, too clayey.	Severe: too clayey.
42 Nueces	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
43:*					
Nueces	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
Sarita	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
44 Olmito	Moderate: too clayey.	Moderate: too clayey.	Severe: too clayey.	Moderate: too clayey.	Severe: too clayey.
45,* 46,* 47.* Pits					
48 Racombes	Severe: floods.	Slight	Slight	Slight	Slight.
49 Racombes	Severe: floods, excess salt.	Severe: excess salt.	Severe: excess salt.	Moderate: wetness.	Severe: excess salt, droughty.
50 Ramadero	Severe: floods.	Slight	Moderate: floods.	Slight	Moderate: floods.
51:*					
Randado	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Severe: thin layer.
Cuevitas	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Severe: thin layer.
52 Raymondville	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: too clayey.	Moderate: too clayey.
53 Raymondville	Severe: excess salt.	Severe: excess salt.	Severe: excess salt.	Moderate: too clayey.	Severe: excess salt.
54:*					
Raymondville	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: too clayey.	Moderate: too clayey.
Urban land.					
55 Reynosa	Slight	Slight	Slight	Severe: erodes easily.	Slight.
56 Reynosa	Severe: excess salt.	Severe: excess salt.	Severe: excess salt.	Severe: erodes easily.	Severe: excess salt, droughty.
57:*					
Reynosa	Slight	Slight	Slight	Severe: erodes easily.	Slight.
Urban land.					

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
58 Rio	Severe: floods, ponding.	Severe: ponding.	Severe: ponding, floods.	Severe: ponding.	Severe: ponding, floods.
59 Rio	Severe: floods, ponding, excess salt.	Severe: ponding, excess salt.	Severe: ponding, floods, excess salt.	Severe: ponding.	Severe: excess salt, ponding, floods.
60 Rio	Severe: floods, ponding.	Severe: ponding.	Severe: ponding, floods.	Severe: ponding.	Severe: ponding, floods.
61 Rio	Severe: floods, ponding, excess salt.	Severe: ponding, excess salt.	Severe: ponding, floods, excess salt.	Severe: ponding.	Severe: excess salt, ponding, floods.
62 Rio Grande	Severe: floods.	Moderate: dusty.	Moderate: floods.	Severe: erodes easily.	Moderate: floods.
63 Rio Grande	Severe: floods.	Slight	Moderate: floods.	Severe: erodes easily.	Moderate: floods.
64 Runn	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Moderate: too clayey.	Severe: too clayey.
65 Runn	Severe: excess salt.	Severe: excess salt.	Severe: too clayey.	Moderate: too clayey.	Severe: excess salt, too clayey.
66 Sarita	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
67 Tiocano	Severe: floods, ponding, percs slowly.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding, percs slowly.	Severe: ponding, too clayey.	Severe: ponding, floods, too clayey.
68.* Urban land					
69.* Ustorthents					
70 Willacy	Slight	Slight	Slight	Slight	Slight.
71 Willacy	Slight	Slight	Moderate: slope.	Slight	Slight.
72:* Willacy	Slight	Slight	Slight	Slight	Slight.
Urban land.					
73 Zalla	Severe: floods.	Moderate: too sandy.	Moderate: floods.	Severe: too sandy.	Moderate: droughty, floods.
74 Zalla	Severe: floods.	Moderate: dusty.	Moderate: floods.	Moderate: dusty.	Moderate: droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
1.[1] Arents									
2. Benito	Poor	Poor	Poor	Poor	Poor	Good	Poor	Fair	Poor.
3, 4. Brennan	Fair[2]	Fair[2]	Fair	Fair	Poor[3]	Very poor[3]	Fair[2]	Very poor[3]	Fair.
5, 6. Camargo	Fair[2]	Fair[2]	Fair	Good	Poor[2]	Very poor[2]	Fair	Very poor[2]	Fair.
7. Cameron	Good	Good	Fair	Fair	Poor	Poor[2]	Fair[2]	Poor[3]	Fair.
8. Comitas	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
9, 10, 11. Delmita	Good	Good	Good	Good	Poor	Poor[2]	Good	Poor[3]	Good.
12. Delmita	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
13:[1]									
Delmita	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
Randado	Poor	Fair	Fair	Poor	Poor	Very poor	Fair	Very poor	Poor.
14. Falfurrias	Very poor	Very poor	Fair	Good	Very poor	Very poor	Poor	Very poor	Fair.
15. Grulla	Poor	Fair	Fair	Fair	Good	Good	Fair	Good	Fair.
16, 17, 18. Hargill	Good	Good	Good	Good	Poor[3]	Very poor[3]	Good	Very poor[3]	Good.
19. Harlingen	Fair	Fair	Fair	Fair	Poor[2]	Poor[2]	Fair	Poor[2]	Fair.
20. Harlingen	Poor	Poor	Poor	Poor	Poor[2]	Poor[2]	Poor	Poor[2]	Poor.
21:[1]									
Harlingen.									
Urban land.									
22, 23, 24. Hebbronville	Fair	Fair	Good	Fair	Poor	Very poor	Fair	Very poor	Fair.
25, 26. Hidalgo	Good	Good	Good	Good	Poor[3]	Very poor[3]	Good	Very poor[3]	Good.
27. Hidalgo	Fair	Good	Good	Good	Poor	Very poor	Fair	Very poor	Good.
28, 29. Hidalgo	Good	Good	Good	Good	Poor[3]	Very poor[3]	Good	Very poor[3]	Good.
30. Hidalgo	Poor	Poor	Poor	Fair	Fair	Fair	Poor	Fair	Poor.

See footnotes at end of table.

TABLE 11.--WILDLIFE HABITAT POTENTIALS--Continued

Map symbol and soil name	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
31:[1]									
Hidalgo.									
Urban land.									
32:[1]									
Jimenez	Very poor	Very poor	Poor	Fair	Very poor	Very poor	Very poor	Very poor	Poor.
Quemado	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
33 Laredo	Good	Good	Good	Fair	Poor[2]	Very poor[2]	Good	Very poor[2]	Fair.
34 Matamoros	Good	Good	Fair	Fair	Poor[2]	Poor[2]	Good	Poor[2]	Fair.
35, 36, 37, 38 McAllen	Fair[2]	Good	Good	Good	Poor[3]	Very poor[3]	Good	Very poor[3]	Good.
39 Mercedes	Fair	Fair	Fair	Fair	Poor[2]	Poor[2]	Fair	Poor[2]	Fair.
40 Mercedes	Poor	Poor	Poor	Poor	Poor[2]	Poor[2]	Poor	Poor[2]	Poor.
41 Mercedes	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Poor	Fair
42 Nueces	Fair	Poor	Good	Good	Poor	Poor	Fair	Poor	Good.
43:[1]									
Nueces	Fair	Poor	Good	Good	Poor	Poor	Fair	Poor	Good.
Sarita	Fair	Fair	Fair	Good	Poor	Very poor	Fair	Very poor	Fair.
44 Olmito	Good	Good	Fair	Fair	Poor[2]	Poor[2]	Good	Poor[2]	Fair.
45,[1] 46,[1] 47.[1] Pits									
48 Racombes	Good	Good	Good	Good	Poor[2]	Very poor[2]	Good	Poor[2]	Good.
49 Racombes	Poor	Poor	Poor	Poor	Poor	Good	Very poor	Fair	Poor.
50 Ramadero	Good	Good	Good	Good	Poor[2]	Very poor[2]	Good	Very poor[2]	Good.
51:[1]									
Randado	Poor	Fair	Fair	Poor	Poor	Very poor	Fair	Very poor	Poor.
Cuevitas	Poor	Poor	Poor	Fair	Poor	Very poor	Poor	Very poor	Poor.
52 Raymondville	Good	Good	Fair	Good	Poor[2]	Very poor[2]	Good	Very poor[2]	Fair.
53 Raymondville	Poor	Poor	Poor	Poor	Good	Good	Very poor	Good	Poor.
54:[1]									
Raymondville.									
Urban land.									

See footnotes at end of table.

TABLE 11.--WILDLIFE HABITAT POTENTIALS--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Wetland wildlife	Rangeland wildlife
55 Reynosa	Fair[2]	Fair[2]	Fair	Fair	Poor[2]	Very poor	Fair	Very poor[3]	Fair.
56 Reynosa	Poor	Poor	Poor	Poor	Good	Good	Poor	Good	Poor.
Urban land.									
57:[1] Reynosa.									
Urban land.									
58 Rio	Good	Good	Fair	Good	Good	Good	Good	Good	Fair.
59 Rio	Poor	Poor	Poor	Poor	Good	Good	Poor	Good	Poor.
60 Rio	Good	Good	Fair	Good	Good	Good	Good	Good	Fair.
61 Rio	Poor	Poor	Poor	Poor	Good	Good	Poor	Good	Poor.
62, 63 Rio Grande	Good	Good	Fair	Good	Poor	Very poor	Good	Very poor	Fair.
64 Runn	Fair[2]	Fair[2]	Fair	Fair	Poor[3]	Poor[2]	Fair[2]	Poor[3]	Fair.
65 Runn	Poor	Poor	Poor	Poor	Fair	Good	Poor	Fair	Poor.
66 Sarita	Fair	Fair	Fair	Good	Poor	Very poor	Fair	Very poor	Fair.
67 Tiocano	Very poor	Poor	Poor	Fair	Good	Good	Poor	Good	Poor.
68.[1] Urban land									
69.[1] Ustorthents									
70, 71 Willacy	Good	Good	Good	Good	Poor[3]	Very poor[3]	Good	Very poor[3]	Good.
72:[1] Willacy.									
Urban land.									
73, 74 Zalla	Poor	Fair	Fair	Good	Very poor	Very poor	Fair	Very poor	Fair.

[1] See description of the map unit for composition and behavior characteristics of the map unit.
[2] Good if irrigated.
[3] Fair if irrigated.

TABLE 12.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1.* Arents						
2 Benito	Severe: cutbanks cave, floods.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: low strength, floods, shrink-swell.	Severe: excess salt, too clayey.
3, 4 Brennan	Slight	Slight	Slight	Slight	Moderate: low strength.	Slight.
5, 6 Camargo	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods.	Moderate: floods.
7 Cameron	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength.	Severe: too clayey.
8 Comitas	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: low strength.	Moderate: too sandy.
9, 10, 11 Delfina	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
12 Delmita	Moderate: cemented pan.	Slight	Moderate: cemented pan.	Slight	Slight	Moderate: cemented pan.
13:*						
Delmita	Moderate: cemented pan.	Slight	Moderate: cemented pan.	Slight	Slight	Moderate: cemented pan.
Randado	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Moderate: cemented pan.	Severe: thin layer.
14 Falfurrias	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
15 Grulla	Severe: ponding.	Severe: floods, ponding, shrink-swell.	Severe: floods, ponding, shrink-swell.	Severe: floods, ponding, shrink-swell.	Severe: low strength, ponding, floods.	Severe: ponding, floods, too clayey.
16, 17 Hargill	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.	Slight.
18 Hargill	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, shrink-swell.	Slight.
19 Harlingen	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
20 Harlingen	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: excess salt, too clayey.
21:*						
Harlingen	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
Urban land.						

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
22, 23 Hebbronville	Slight	Slight	Slight	Slight	Slight	Slight.
24 Hebbronville	Slight	Slight	Slight	Moderate: slope.	Slight	Slight.
25, 26 Hidalgo	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
27 Hidalgo	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
28, 29 Hidalgo	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
30 Hidalgo	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Severe: excess salt, droughty.
31:*						
Hidalgo	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
Urban land.						
32:*						
Jimenez	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Moderate: slope, cemented pan.	Moderate: cemented pan.	Severe: small stones, thin layer.
Quemado	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Moderate: slope, cemented pan.	Moderate: cemented pan.	Severe: small stones, thin layer.
33 Laredo	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
34 Matamoros	Moderate: too clayey, floods.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: low strength, floods, shrink-swell.	Severe: too clayey.
35, 36 McAllen	Slight	Slight	Slight	Slight	Moderate: low strength.	Slight.
37 McAllen	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.	Slight.
38 McAllen	Slight	Slight	Slight	Slight	Moderate: low strength.	Slight.
39 Mercedes	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
40 Mercedes	Severe: too clayey, cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: excess salt, too clayey.
41 Mercedes	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
42 Nueces	Severe: cutbanks cave.	Slight	Moderate: shrink-swell.	Slight	Slight	Moderate: droughty.
43:*						
Nueces	Severe: cutbanks cave.	Slight	Moderate: shrink-swell.	Slight	Slight	Moderate: droughty.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
43:*						
Sarita	Severe: cutbanks cave.	Slight	Moderate: shrink-swell.	Slight	Slight	Severe: droughty.
44 Olmito	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
45,* 46,* 47.* Pits						
48 Racombes	Slight	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: low strength, floods, shrink-swell.	Slight.
49 Racombes	Severe: wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Moderate: low strength, wetness, floods.	Severe: excess salt, droughty.
50 Ramadero	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods.	Moderate: floods.
51:*						
Randado	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Moderate: cemented pan.	Severe: thin layer.
Cuevitas	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Moderate: cemented pan.	Severe: thin layer.
52 Raymondville	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
53 Raymondville	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: excess salt.
54:*						
Raymondville	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
Urban land.						
55 Reynosa	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
56 Reynosa	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Moderate: low strength, shrink-swell.	Severe: excess salt, droughty.
57:*						
Reynosa	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
Urban land.						
58 Rio	Severe: ponding.	Severe: floods, ponding.	Severe: floods, ponding.	Severe: floods, ponding.	Severe: low strength, ponding, floods.	Severe: ponding, floods.
59 Rio	Severe: ponding.	Severe: floods, ponding.	Severe: floods, ponding.	Severe: floods, ponding.	Severe: low strength, ponding, floods.	Severe: excess salt, ponding, floods.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
60----------------- Rio	Severe: ponding.	Severe: floods, ponding.	Severe: floods, ponding.	Severe: floods, ponding.	Severe: low strength, ponding, floods.	Severe: ponding, floods.
61----------------- Rio	Severe: ponding.	Severe: floods, ponding.	Severe: floods, ponding.	Severe: floods, ponding.	Severe: low strength, ponding, floods.	Severe: excess salt, ponding, floods.
62, 63------------ Rio Grande	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
64----------------- Runn	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
65----------------- Runn	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: excess salt, too clayey.
66----------------- Sarita	Severe: cutbanks cave.	Slight----------	Moderate: shrink-swell.	Slight----------	Slight----------	Severe: droughty.
67----------------- Tiocano	Severe: cutbanks cave, ponding.	Severe: floods, ponding, shrink-swell.	Severe: floods, ponding, shrink-swell.	Severe: floods, ponding, shrink-swell.	Severe: low strength, ponding, floods.	Severe: ponding, floods, too clayey.
68.* Urban land						
69.* Ustorthents						
70, 71------------ Willacy	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: low strength.	Slight.
72:* Willacy-----------	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: low strength.	Slight.
Urban land.						
73----------------- Zalla	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: droughty, floods.
74----------------- Zalla	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.	Moderate: droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1.* Arents					
2 Benito	Severe: floods, percs slowly.	Slight	Severe: floods, wetness, too clayey.	Severe: floods.	Poor: too clayey, hard to pack.
3 Brennan	Slight	Moderate: seepage.	Slight	Slight	Good.
4 Brennan	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
5, 6 Camargo	Severe: floods.	Moderate: seepage.	Severe: floods.	Severe: floods.	Fair: too clayey.
7 Cameron	Moderate: wetness.	Severe: seepage.	Severe: seepage, wetness.	Severe: seepage.	Poor: too clayey.
8 Comitas	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
9, 10, 11 Delfina	Severe: wetness, percs slowly.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Fair: wetness.
12 Delmita	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Fair: area reclaim, thin layer.
13:* Delmita	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Fair: area reclaim, thin layer.
Randado	Severe: cemented pan.	Severe: cemented pan, seepage.	Severe: cemented pan.	Slight	Poor: area reclaim, thin layer.
14 Falfurrias	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
15 Grulla	Severe: floods, ponding, percs slowly.	Severe: floods, ponding.	Severe: floods, ponding, too clayey.	Severe: floods, ponding.	Poor: too clayey, hard to pack, ponding.
16 Hargill	Slight	Moderate: seepage.	Slight	Slight	Good.
17, 18 Hargill	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
19 Harlingen	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
20 Harlingen	Severe: percs slowly.	Slight	Severe: too clayey, excess salt.	Slight	Poor: excess salt, too clayey, hard to pack.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
21:*					
Harlingen	Severe: percs slowly.	Slight	Severe: too clayey.	Slight.	Poor: too clayey, hard to pack.
Urban land.					
22, 23, 24 Hebbronville	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
25 Hidalgo	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
26, 27 Hidalgo	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
28 Hidalgo	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
29 Hidalgo	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
30 Hidalgo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
31:*					
Hidalgo	Moderate: percs slowly.	Moderate: percs slowly.	Slight:	Slight:	Good.
Urban land.					
32:*					
Jimenez	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Poor: area reclaim.
Quemado	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan, large stones.	Severe: cemented pan.	Poor: area reclaim, small stones.
33 Laredo	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
34 Matamoros	Severe: floods, percs slowly.	Severe: floods.	Severe: floods, too clayey.	Severe: floods.	Poor: too clayey, hard to pack.
35 McAllen	Slight	Moderate: seepage.	Slight	Slight	Good.
36, 37 McAllen	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
38 McAllen	Slight	Moderate: seepage.	Slight	Slight	Good.
39 Mercedes	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
40 Mercedes	Severe: percs slowly.	Slight	Severe: too clayey, excess salt.	Slight	Poor: excess salt, too clayey, hard to pack.
41 Mercedes	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
42-----------------Nueces	Severe: percs slowly.	Severe: seepage.	Slight-----------	Severe: seepage.	Poor: too sandy.
43:*					
Nueces-------------	Severe: percs slowly.	Severe: seepage.	Slight-----------	Severe: seepage.	Poor: too sandy.
Sarita-------------	Slight-----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
44-----------------Olmito	Severe: percs slowly.	Slight-----------	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
45,* 46,* 47.* Pits					
48-----------------Racombes	Moderate: floods, percs slowly.	Moderate: seepage.	Moderate: floods.	Moderate: floods.	Good.
49-----------------Racombes	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
50-----------------Ramadero	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
51:*					
Randado------------	Severe: cemented pan.	Severe: cemented pan, seepage.	Severe: cemented pan.	Slight-----------	Poor: area reclaim, thin layer.
Cuevitas-----------	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight-----------	Poor: area reclaim, thin layer.
52-----------------Raymondville	Severe: percs slowly.	Slight-----------	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
53-----------------Raymondville	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness, too clayey, excess salt.	Severe: wetness.	Poor: too clayey, hard to pack, excess salt.
54:*					
Raymondville-------	Severe: percs slowly.	Slight-----------	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
Urban land.					
55-----------------Reynosa	Slight-----------	Moderate: seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
56-----------------Reynosa	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
57:*					
Reynosa------------	Slight-----------	Moderate: seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
Urban land.					

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
58------------------ Rio	Severe: floods, ponding, percs slowly.	Severe: ponding.	Severe: floods, ponding.	Severe: floods, ponding.	Poor: ponding.
59------------------ Rio	Severe: floods, ponding, percs slowly.	Severe: floods, ponding.	Severe: floods, ponding.	Severe: floods, ponding.	Poor: hard to pack, ponding.
60------------------ Rio	Severe: floods, ponding, percs slowly.	Severe: ponding.	Severe: floods, ponding.	Severe: floods, ponding.	Poor: ponding.
61------------------ Rio	Severe: floods, ponding, percs slowly.	Severe: floods, ponding.	Severe: floods, ponding.	Severe: floods, ponding.	Poor: hard to pack, ponding.
62, 63-------------- Rio Grande	Severe: floods.	Severe: seepage, floods.	Severe: floods, seepage.	Severe: floods, seepage.	Good.
64------------------ Runn	Severe: percs slowly.	Slight-----------	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
65------------------ Runn	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
66------------------ Sarita	Slight-----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
67------------------ Tiocano	Severe: floods, ponding, percs slowly.	Slight-----------	Severe: floods, ponding, too clayey.	Severe: floods, ponding.	Poor: too clayey, hard to pack, ponding.
68.* Urban land					
69.* Ustorthents					
70, 71-------------- Willacy	Slight-----------	Moderate: seepage.	Slight-----------	Slight-----------	Good.
72:*					
Willacy-------------	Slight-----------	Moderate: seepage.	Slight-----------	Slight-----------	Good.
Urban land.					
73------------------ Zalla	Severe: floods, poor filter.	Severe: seepage, floods.	Severe: floods, seepage.	Severe: floods, seepage.	Poor: seepage, too sandy.
74------------------ Zalla	Severe: poor filter.	Severe: seepage, floods.	Severe: seepage.	Severe: seepage.	Poor: seepage, too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1.* Arents				
2 Benito	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
3, 4 Brennan	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
5 Camargo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
6 Camargo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
7 Cameron	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
8 Comitas	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
9 Delfina	Fair: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
10, 11 Delfina	Fair: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
12 Delmita	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too sandy, thin layer.
13:*				
Delmita	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer.
Randado	Poor: thin layer.	Improbable: excess fines, thin layer.	Improbable: excess fines, thin layer.	Poor: area reclaim, thin layer.
14 Falfurrias	Good	Probable	Improbable: too sandy.	Poor: too sandy.
15 Grulla	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
16, 17, 18 Hargill	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
19 Harlingen	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
20 Harlingen	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
21:*				
Harlingen	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Urban land.				
22, 23, 24 Hebbronville	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
25, 26, 27 Hidalgo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
28, 29 Hidalgo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
30 Hidalgo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt.
31:*				
Hidalgo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Urban land.				
32:*				
Jimenez	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
Quemado	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
33 Laredo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
34 Matamoros	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
35, 36, 37 McAllen	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: excess lime.
38 McAllen	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, excess lime.
39 Mercedes	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
40 Mercedes	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
41 Mercedes	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
42 Nueces	Fair: low strength.	Probable	Improbable: too sandy.	Poor: too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
43:*				
Nueces	Fair: low strength.	Probable	Improbable: too sandy.	Poor: too sandy.
Sarita	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
44 Olmito	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
45,* 46,* 47.* Pits				
48 Racombes	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
49 Racombes	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt.
50 Ramadero	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
51:*				
Randado	Poor: thin layer.	Improbable: excess fines, thin layer.	Improbable: excess fines, thin layer.	Poor: area reclaim, thin layer.
Cuevitas	Poor: thin layer.	Improbable: excess fines, thin layer.	Improbable: excess fines, thin layer.	Poor: area reclaim, thin layer.
52 Raymondville	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
53 Raymondville	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt.
54:*				
Raymondville	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Urban land.				
55 Reynosa	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
56 Reynosa	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt.
57:*				
Reynosa	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Urban land.				
58 Rio	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
59 Rio	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, wetness.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
60 Rio	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
61 Rio	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, wetness.
62, 63 Rio Grande	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
64 Runn	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
65 Runn	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
66 Sarita	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
67 Tiocano	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
68.* Urban land				
69.* Ustorthents				
70, 71 Willacy	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
72:* Willacy	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Urban land.				
73 Zalla	Good	Probable	Improbable: too sandy.	Poor: too sandy.
74 Zalla	Fair: low strength.	Probable	Improbable: too sandy.	Fair: thin layer.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
1.* Arents						
2 Benito	Moderate: seepage.	Moderate: hard to pack, excess salt.	Percs slowly, excess salt.	Slow intake, percs slowly, excess salt.	Percs slowly	Excess salt, percs slowly.
3, 4 Brennan	Moderate: seepage.	Moderate: piping.	Favorable	Favorable	Favorable	Favorable.
5, 6 Camargo	Moderate: seepage.	Moderate: piping.	Floods	Erodes easily	Erodes easily	Erodes easily.
7 Cameron	Severe: seepage.	Moderate: piping.	Favorable	Slow intake	Favorable	Favorable.
8 Comitas	Severe: seepage.	Moderate: seepage, piping.	Cutbanks cave	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
9 Delfina	Moderate: seepage.	Moderate: wetness.	Favorable	Wetness, droughty, fast intake.	Soil blowing	Favorable.
10, 11 Delfina	Moderate: seepage.	Moderate: wetness.	Favorable	Wetness	Favorable	Favorable.
12 Delmita	Severe: seepage.	Moderate: thin layer.	Cemented pan	Soil blowing, cemented pan.	Cemented pan, soil blowing.	Cemented pan.
13:* Delmita	Severe: seepage.	Moderate: thin layer.	Cemented pan	Soil blowing, cemented pan.	Cemented pan, soil blowing.	Cemented pan.
Randado	Severe: cemented pan, seepage.	Severe: thin layer.	Cemented pan	Cemented pan	Cemented pan	Cemented pan.
14 Falfurrias	Severe: seepage.	Severe: seepage, piping.	Cutbanks cave	Droughty, fast intake.	Too sandy	Droughty.
15 Grulla	Slight	Severe: hard to pack, ponding.	Ponding, percs slowly, floods.	Ponding, slow intake, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
16, 17 Hargill	Moderate: seepage.	Moderate: piping.	Favorable	Favorable	Favorable	Favorable.
18 Hargill	Moderate: seepage, slope.	Moderate: piping.	Slope	Slope	Favorable	Favorable.
19 Harlingen	Slight	Severe: hard to pack.	Percs slowly	Slow intake, percs slowly.	Percs slowly	Excess salt, percs slowly.
20 Harlingen	Slight	Moderate: hard to pack, excess salt.	Percs slowly, excess salt.	Droughty, slow intake, percs slowly.	Percs slowly	Excess salt, droughty, percs slowly.
21:* Harlingen	Slight	Severe: hard to pack.	Percs slowly	Slow intake, percs slowly.	Percs slowly	Excess salt, percs slowly.
Urban land.						

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
22, 23, 24 Hebbronville	Severe: seepage.	Moderate: piping.	Favorable	Favorable	Soil blowing	Favorable.
25, 26 Hidalgo	Moderate: seepage.	Moderate: piping.	Favorable	Favorable	Favorable	Favorable.
27 Hidalgo	Moderate: seepage, slope.	Moderate: piping.	Slope	Slope	Favorable	Favorable.
28, 29 Hidalgo	Moderate: seepage.	Moderate: piping.	Favorable	Favorable	Favorable	Favorable.
30 Hidalgo	Moderate: seepage.	Moderate: piping, wetness, excess salt.	Excess salt	Wetness, excess salt.	Wetness	Excess salt, droughty.
31:*						
Hidalgo	Moderate: seepage.	Moderate: piping.	Favorable	Favorable	Favorable	Favorable.
Urban land.						
32:*						
Jimenez	Severe: cemented pan.	Severe: thin layer.	Cemented pan	Droughty, cemented pan, slope.	Large stones, cemented pan.	Large stones, droughty.
Quemado	Severe: cemented pan.	Severe: seepage.	Cemented pan	Droughty, cemented pan, slope.	Large stones, cemented pan.	Large stones, droughty, cemented pan.
33 Laredo	Severe: seepage.	Moderate: piping.	Favorable	Erodes easily	Erodes easily	Erodes easily.
34 Matamoros	Slight	Moderate: hard to pack.	Percs slowly, floods.	Slow intake, percs slowly, floods.	Percs slowly	Percs slowly.
35, 36, 37, 38 McAllen	Moderate: seepage.	Moderate: piping.	Favorable	Favorable	Favorable	Favorable.
39 Mercedes	Slight	Severe: hard to pack.	Percs slowly	Slow intake, percs slowly.	Percs slowly	Percs slowly.
40 Mercedes	Slight	Severe: hard to pack.	Percs slowly	Slow intake, percs slowly, excess salt.	Percs slowly	Excess salt, droughty, percs slowly.
41 Mercedes	Slight	Severe: hard to pack.	Percs slowly	Slow intake, percs slowly.	Percs slowly	Percs slowly.
42 Nueces	Moderate: seepage.	Severe: seepage, piping.	Cutbanks cave	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
43:*						
Nueces	Moderate: seepage.	Severe: seepage, piping.	Cutbanks cave	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
Sarita	Severe: seepage.	Severe: seepage, seepage.	Cutbanks cave	Droughty, fast intake.	Too sandy	Droughty.
44 Olmito	Slight	Moderate: hard to pack.	Percs slowly	Slow intake, percs slowly.	Percs slowly	Percs slowly.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
45,* 46,* 47.* Pits						
48 Racombes	Moderate: seepage.	Slight	Favorable	Favorable	Favorable	Favorable.
49 Racombes	Moderate: seepage.	Severe: wetness, excess salt.	Excess salt	Wetness, droughty, excess salt.	Wetness	Excess salt, droughty.
50 Ramadero	Moderate: seepage.	Moderate: piping.	Floods	Floods	Favorable	Favorable.
51:* Randado	Severe: cemented pan, seepage.	Severe: thin layer.	Cemented pan	Cemented pan	Cemented pan	Cemented pan.
Cuevitas	Severe: cemented pan, seepage.	Severe: thin layer.	Cemented pan	Cemented pan	Cemented pan	Cemented pan.
52 Raymondville	Slight	Moderate: hard to pack.	Percs slowly	Slow intake, percs slowly.	Percs slowly	Percs slowly.
53 Raymondville	Slight	Severe: excess salt.	Percs slowly, excess salt.	Wetness, droughty, excess salt.	Wetness, percs slowly.	Excess salt, droughty, percs slowly.
54:* Raymondville	Slight	Moderate: hard to pack.	Percs slowly	Slow intake, percs slowly.	Percs slowly	Percs slowly.
Urban land.						
55 Reynosa	Severe: seepage.	Moderate: thin layer, piping.	Favorable	Erodes easily	Erodes easily	Erodes easily.
56 Reynosa	Severe: seepage.	Moderate: piping, wetness, excess salt.	Excess salt	Wetness, excess salt, erodes easily.	Erodes easily, wetness.	Excess salt, erodes easily, droughty.
57:* Reynosa	Severe: seepage.	Moderate: thin layer, piping.	Favorable	Erodes easily	Erodes easily	Erodes easily.
Urban land.						
58 Rio	Slight	Severe: ponding.	Ponding, percs slowly, floods.	Ponding, percs slowly, floods.	Ponding, percs slowly.	Wetness, percs slowly.
59 Rio	Slight	Severe: ponding, excess salt.	Ponding, percs slowly, floods.	Ponding, droughty, percs slowly.	Ponding, percs slowly.	Wetness, excess salt, droughty.
60 Rio	Slight	Severe: ponding.	Ponding, percs slowly, floods.	Ponding, percs slowly, floods.	Ponding, percs slowly.	Wetness, percs slowly.
61 Rio	Slight	Severe: ponding, excess salt.	Ponding, percs slowly, floods.	Ponding, droughty, percs slowly.	Ponding, percs slowly.	Wetness, excess salt, droughty.
62, 63 Rio Grande	Severe: seepage.	Severe: piping.	Floods	Erodes easily, floods.	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
64-----------------Runn	Moderate: seepage.	Moderate: hard to pack.	Percs slowly---	Slow intake, percs slowly, excess salt.	Percs slowly---	Percs slowly.
65-----------------Runn	Moderate: seepage.	Moderate: hard to pack, wetness, excess salt.	Percs slowly, excess salt.	Slow intake, percs slowly, excess salt.	Wetness, percs slowly.	Excess salt, erodes easily, percs slowly.
66-----------------Sarita	Severe: seepage.	Severe: seepage, seepage.	Cutbanks cave	Droughty, fast intake.	Too sandy------	Droughty.
67-----------------Tiocano	Slight---------	Severe: hard to pack, ponding.	Ponding, percs slowly, floods.	Ponding, slow intake, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
68.* Urban land						
69.* Ustorthents						
70, 71------------Willacy	Moderate: seepage.	Slight---------	Favorable------	Favorable------	Favorable------	Favorable.
72:*						
Willacy-----------	Moderate: seepage.	Slight---------	Favorable------	Favorable------	Favorable------	Favorable.
Urban land.						
73, 74------------Zalla	Severe: seepage.	Severe: seepage, piping.	Floods---------	Droughty, fast intake.	Too sandy------	Droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

[Absence of an entry indicates that data were not estimated]

Map symbol and soil name	Depth	USDA texture	Classification		Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	4	10	40	200		
	In								Pct	
1.* Arents										
2 Benito	0-7	Clay	CH	A-7-6	100	100	100	95-100	75-94	48-64
	7-65	Clay	CH	A-7-6	100	100	100	95-100	75-94	48-64
3, 4 Brennan	0-13	Fine sandy loam	SM, SM-SC, SC	A-2-4, A-4	100	98-100	70-100	20-45	<30	NP-9
	13-65	Sandy clay loam, loam.	SC, CL	A-2-4, A-2-6, A-4, A-6	95-100	90-100	60-100	30-59	22-39	8-22
5 Camargo	0-8	Silt loam	CL, CL-ML	A-6, A-4	100	100	95-100	70-100	20-35	4-16
	8-65	Stratified silty clay loam to very fine sandy loam.	CL	A-6, A-7-6	100	100	95-100	70-100	30-45	11-25
6 Camargo	0-8	Silty clay loam	CL	A-6, A-7-6	100	100	95-100	70-100	30-45	11-25
	8-65	Stratified silty clay loam to very fine sandy loam.	CL	A-6, A-7-6	100	100	95-100	70-100	30-45	11-25
7 Cameron	0-30	Silty clay	CH, CL	A-7-6	100	100	100	90-100	48-68	25-41
	30-65	Silt loam, loam	CL	A-4, A-6	100	95-100	90-100	70-95	25-35	8-15
8 Comitas	0-28	Loamy fine sand	SM, SM-SC	A-2-4	95-100	95-100	85-100	15-25	<25	NP-4
	28-80	Fine sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2-4, A-2-6, A-4, A-6	95-100	90-100	80-100	23-50	<34	NP-14
9 Delfina	0-13	Loamy fine sand	SM, SM-SC	A-2-4, A-4	100	100	85-100	20-45	<25	NP-7
	13-34	Sandy clay loam, clay loam.	SC, CL	A-6, A-7-6	100	95-100	90-100	40-55	31-48	18-35
	34-72	Sandy clay loam, fine sandy loam.	SC	A-6, A-7-6	90-100	75-98	70-97	36-50	30-46	16-31
10, 11 Delfina	0-13	Fine sandy loam	SM-SC, SC, SM	A-2-4, A-4	100	100	90-100	25-50	19-30	3-10
	13-34	Sandy clay loam, clay loam.	SC, CL	A-6, A-7-6	100	95-100	90-100	40-55	31-48	18-35
	34-72	Sandy clay loam, fine sandy loam.	SC	A-6, A-7-6	90-100	75-98	70-97	36-50	30-46	16-31
12 Delmita	0-13	Loamy fine sand	SM, SM-SC, SP-SM	A-2-4	100	95-100	85-100	11-25	<25	NP-7
	13-34	Sandy clay loam, fine sandy loam.	SC	A-2-4, A-2-6, A-4, A-6	100	100	90-100	30-50	27-39	8-18
	34-60	Indurated	---	---	---	---	---	---	---	---
13:* Delmita	0-13	Fine sandy loam	SM, SM-SC	A-2-4	100	100	90-100	20-35	<27	NP-7
	13-34	Sandy clay loam, fine sandy loam.	SC	A-2-4, A-2-6, A-4, A-6	100	100	90-100	30-50	27-39	8-18
	34-60	Indurated	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	4	10	40	200		
	In								Pct	
13:*										
Randado	0-9	Fine sandy loam	SM, SM-SC	A-2-4	75-100	70-100	70-100	20-35	<25	NP-7
	9-16	Fine sandy loam, sandy clay loam.	SC, SM-SC, GC	A-2-4, A-2-6, A-4, A-6	65-100	60-100	60-100	25-50	25-34	7-14
	16-60	Cemented	---	---	---	---	---	---	---	---
14 Falfurrias	0-80	Fine sand	SP-SM, SM	A-2-4, A-3	100	100	75-100	5-25	<25	NP-3
15 Grulla	0-7	Clay	CL, CH	A-7-6	100	100	100	90-100	41-55	20-30
	7-65	Silty clay, clay	CH	A-7-6	100	100	100	90-100	52-66	28-39
16, 17, 18 Hargill	0-18	Fine sandy loam	SC, SM-SC, SM	A-2-4	100	95-100	95-100	17-35	<30	NP-8
	18-63	Sandy clay loam	SC, CL	A-6	100	95-100	95-100	40-55	30-40	11-20
	63-80	Sandy clay loam	SC	A-2-4, A-2-6, A-4, A-6	85-100	80-100	75-100	34-50	28-39	9-18
19, 20 Harlingen	0-8	Clay	CH	A-7-6	100	100	100	90-100	51-85	32-60
	8-35	Clay	CH	A-7-6	100	100	100	95-100	65-85	50-65
	35-72	Clay	CH	A-7-6	100	100	100	95-100	65-85	50-65
21:*										
Harlingen	0-8	Clay	CH	A-7-6	100	100	100	90-100	51-85	32-60
	8-35	Clay	CH	A-7-6	100	100	100	95-100	65-85	50-65
	35-72	Clay	CH	A-7-6	100	100	100	95-100	65-85	50-65
Urban land.										
22, 23, 24 Hebbronville	0-17	Sandy loam	SM	A-2-4	100	100	75-100	13-24	<25	NP-4
	17-58	Fine sandy loam, loam.	SM, SM-SC	A-2-4	100	100	90-100	20-30	<30	NP-7
	58-65	Fine sandy loam, loam.	SM-SC, SC	A-2-4, A-4, A-2-6, A-6	95-100	90-100	90-100	20-40	20-30	4-13
25, 26, 27 Hidalgo	0-17	Fine sandy loam	SC, SM-SC	A-4, A-6	100	95-100	90-100	36-50	20-30	4-11
	17-28	Sandy clay loam, clay loam.	SC, CL	A-6	100	95-100	90-100	36-80	30-40	11-20
	28-80	Clay loam, sandy clay loam.	CL, SC	A-6, A-7-6	90-100	80-100	75-99	44-80	30-44	11-23
28, 29, 30 Hidalgo	0-17	Sandy clay loam	SC, CL	A-6	100	95-100	90-100	36-55	29-40	11-20
	17-28	Sandy clay loam, clay loam.	SC, CL	A-6	100	95-100	90-100	36-80	30-40	11-20
	28-80	Clay loam, sandy clay loam.	CL, SC	A-6, A-7-6	90-100	80-100	75-99	44-80	30-44	11-23
31:*										
Hidalgo	0-17	Sandy clay loam	SC, CL	A-6	100	95-100	90-100	36-50	29-40	11-20
	17-28	Sandy clay loam, clay loam.	SC, CL	A-6	100	95-100	90-100	36-80	30-40	11-20
	28-80	Clay loam, sandy clay loam.	CL, SC	A-6, A-7-6	90-100	80-100	75-99	44-80	30-44	11-23
Urban land.										

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In								Pct	
32:*										
Jimenez----------	0-8	Very gravelly loam.	GC, GM-GC	A-1, A-2-4, A-2-6	30-58	15-40	15-35	15-30	22-35	5-15
	8-10	Cemented---------	---	---	---	---	---	---	---	---
	10-60	Variable---------	---	---	---	---	---	---	---	---
Quemado----------	0-6	Very gravelly sandy loam.	GM, GC, GM-GC	A-1, A-2	30-50	20-50	15-35	15-30	<25	NP-10
	6-12	Very gravelly sandy loam, very gravelly loam, very gravelly sandy clay loam.	GM, GC, GM-GC	A-1, A-2	30-50	20-50	15-35	15-30	18-28	2-10
	12-18	Cemented---------	---	---	---	---	---	---	---	---
	18-60	Variable---------	---	---	---	---	---	---	---	---
33---------------- Laredo	0-14	Silty clay loam	CL	A-6, A-7-6, A-4	100	100	90-100	85-100	28-44	9-22
	14-65	Silty clay loam, silt loam, very fine sandy loam.	CL	A-6, A-7-6, A-4	100	95-100	90-100	70-95	28-43	9-21
34---------------- Matamoros	0-65	Silty clay, stratified silt loam to clay.	CH	A-7-6	100	100	100	95-100	51-65	30-41
35, 36, 37-------- McAllen	0-14	Fine sandy loam	CL, SC, CL-ML, SM-SC	A-4, A-6	100	100	95-100	36-55	21-30	4-11
	14-72	Sandy clay loam, clay loam, fine sandy loam.	CL, SC	A-6	95-100	90-100	85-100	45-70	28-40	11-20
38---------------- McAllen	0-14	Sandy clay loam	CL, SC,	A-6	100	100	95-100	36-55	29-40	11-20
	14-72	Sandy clay loam, clay loam, fine sandy loam.	CL, SC	A-6	95-100	90-100	85-100	45-70	28-40	11-20
39, 40, 41-------- Mercedes	0-19	Clay-------------	CH	A-7-6	85-100	80-100	80-100	75-95	55-76	32-49
	19-57	Clay-------------	CH, CL-CH	A-7-6	85-100	80-100	80-100	75-95	50-76	32-49
	57-65	Clay-------------	CH, CL	A-7-6	85-100	80-100	80-100	75-95	48-76	32-49
42---------------- Nueces	0-29	Fine sand--------	SP-SM, SM, SM-SC	A-2-4, A-3	100	95-100	90-100	8-35	<25	NP-6
	29-72	Sandy clay loam, sandy loam.	SC	A-2-6, A-6	90-100	90-100	80-100	20-50	25-40	11-20
43:*										
Nueces-----------	0-29	Fine sand--------	SP-SM, SM, SM-SC	A-2-4, A-3	100	95-100	90-100	8-35	<25	NP-6
	29-72	Sandy clay loam, sandy loam.	SC	A-2-6, A-6	90-100	90-100	80-100	20-50	25-40	11-20
Sarita-----------	0-48	Fine sand--------	SM-SC, SP-SM, SM	A-2-4, A-3	100	100	65-100	9-35	<25	NP-7
	48-80	Sandy clay loam, fine sandy loam.	SC	A-2-6, A-6	100	100	80-100	30-50	28-40	11-22
44---------------- Olmito	0-47	Silty clay-------	CH	A-7-6	100	100	100	90-100	51-70	28-44
	47-65	Silty clay, silty clay loam.	CH	A-7-6	95-100	90-100	85-100	85-100	51-70	28-44

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	4	10	40	200		
	In								Pct	
45,* 46,* 47.* Pits										
48, 49----------- Racombes	0-13	Sandy clay loam	CL, SC	A-4, A-6	100	100	95-100	45-65	27-35	8-15
	13-49	Sandy clay loam, clay loam.	CL, SC	A-6, A-7	100	95-100	90-100	45-65	34-43	15-22
	49-72	Sandy clay loam, clay loam.	CL, SC	A-6	90-100	80-100	80-95	40-65	30-40	11-20
50--------------- Ramadero	0-21	Sandy clay loam	CL, SC	A-6, A-4	100	100	95-100	45-65	27-39	9-18
	21-65	Sandy clay loam, clay loam.	CL, SC	A-6, A-7	100	95-100	90-100	45-65	32-42	13-21
51:*										
Randado---------	0-9	Fine sandy loam	SM, SM-SC	A-2-4	75-100	70-100	70-100	20-35	<25	NP-7
	9-16	Fine sandy loam, sandy clay loam.	SC, SM-SC, GC	A-2-4, A-2-6, A-4, A-6	65-100	60-100	60-100	25-50	25-34	7-14
	16-60	Cemented---------	---	---	---	---	---	---	---	---
Cuevitas--------	0-8	Fine sandy loam	SM, SM-SC, SC	A-2-4	80-100	80-100	80-100	20-35	<28	NP-9
	8-60	Cemented---------	---	---	---	---	---	---	---	---
52, 53----------- Raymondville	0-15	Clay loam--------	CL	A-6, A-7-6	100	100	95-100	51-85	37-50	18-30
	15-43	Clay, clay loam	CL, CH	A-6, A-7-6	100	95-100	95-100	75-95	38-55	19-35
	43-65	Clay, clay loam	CL, CH	A-7-6	100	85-100	80-100	75-95	40-53	20-30
54:*										
Raymondville----	0-15	Clay loam--------	CL	A-6, A-7-6	100	100	95-100	51-85	37-50	18-30
	15-43	Clay, clay loam	CL, CH	A-6, A-7-6	100	95-100	95-100	75-95	38-55	19-35
	43-65	Clay, clay loam	CL, CH	A-7-6	100	85-100	80-100	75-95	40-53	20-30
Urban land.										
55, 56----------- Reynosa	0-15	Silty clay loam	CL, CL-ML	A-6, A-4, A-7-6	100	100	95-100	80-100	25-45	7-25
	15-48	Silty clay loam, silt loam.	CL	A-6, A-4, A-7-6	100	100	95-100	80-100	28-44	9-23
	48-65	Stratified silty clay loam to silt loam.	CL, CL-ML	A-6, A-4, A-7-6	100	100	90-100	70-100	20-49	4-29
57:*										
Reynosa---------	0-15	Silty clay loam	CL, CL-ML	A-6, A-4, A-7-6	100	100	95-100	80-100	25-45	7-25
	15-48	Silty clay loam, silt loam.	CL	A-6, A-4, A-7-6	100	100	95-100	80-100	28-44	9-23
	48-65	Stratified silty clay loam to silt loam.	CL, CL-ML	A-6, A-4, A-7-6	100	100	90-100	70-100	20-49	4-29
Urban land.										
58, 59----------- Rio	0-12	Fine sandy loam	SC, SM-SC	A-2-4, A-4	95-100	95-100	95-100	30-48	<30	5-10
	12-38	Clay loam, clay	CL, CH	A-7-6	95-100	95-100	95-100	75-95	43-57	21-32
	38-63	Clay loam, sandy clay, sandy clay loam.	CL	A-7-6	95-100	95-100	85-95	55-80	41-50	20-27

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	4	10	40	200		
	In								Pct	
60, 61----------- Rio	0-12	Clay loam--------	CL	A-6, A-7	95-100	95-100	95-100	70-80	35-45	15-22
	12-38	Clay loam, clay	CL, CH	A-7-6	95-100	95-100	95-100	75-95	43-57	21-32
	38-63	Clay loam, sandy clay, sandy clay loam.	CL	A-7-6	95-100	95-100	85-95	55-80	41-50	20-27
62--------------- Rio Grande	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	100	100	95-100	70-95	20-30	4-12
	8-65	Stratified silt loam to loamy very fine sand.	CL, CL-ML	A-4, A-6	100	100	95-100	70-100	20-33	4-12
63--------------- Rio Grande	0-8	Silty clay loam	CL	A-6, A-7	100	100	95-100	80-100	30-43	11-18
	8-65	Stratified silt loam to loamy very fine sand.	CL, CL-ML	A-4, A-6	100	100	95-100	70-100	20-33	4-12
64, 65----------- Runn	0-55	Silty clay-------	CH, CL	A-7-6	100	100	95-100	85-98	43-62	21-36
	55-65	Silty clay, silty clay loam, silt loam.	CH, CL, CL-ML	A-6, A-7-6, A-4	100	95-100	90-100	70-98	21-62	4-36
66--------------- Sarita	0-48	Fine sand--------	SM-SC, SP-SM, SM	A-2-4, A-3	100	100	65-100	9-35	<25	NP-7
	48-80	Sandy clay loam, fine sandy loam.	SC	A-2-6, A-6	100	100	80-100	30-50	28-40	11-22
67--------------- Tiocano	0-65	Clay-------------	CH	A-7-6	100	100	95-100	85-100	56-76	33-49
68.* Urban land										
69.* Ustorthents										
70, 71----------- Willacy	0-14	Fine sandy loam	SC, SM-SC	A-2-4, A-4	100	100	95-100	30-45	20-30	5-10
	14-80	Sandy clay loam, fine sandy loam.	SC, CL	A-4, A-6	95-100	90-100	90-100	36-65	28-40	9-20
72:* Willacy---------	0-14	Fine sandy loam	SC, SM-SC	A-2-4, A-4	100	100	95-100	30-45	20-30	5-10
	14-80	Sandy clay loam, fine sandy loam.	SC, CL	A-4, A-6	95-100	90-100	90-100	36-65	28-40	9-20
Urban land.										
73--------------- Zalla	0-9	Loamy fine sand	SP-SM, SM, SM-SC	A-2-4	95-100	95-100	70-85	10-25	<25	NP-7
	9-65	Loamy fine sand, fine sand, sand.	SP-SM, SM, SM-SC	A-2-4	95-100	95-100	70-85	10-25	<25	NP-7
74--------------- Zalla	0-9	Silt loam--------	CL, CL-ML, ML	A-4, A-6	100	100	90-100	70-80	<30	NP-11
	9-65	Loamy fine sand, fine sand, sand.	SP-SM, SM, SM-SC	A-2-4	95-100	95-100	70-85	10-25	<25	NP-7

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. The symbol < means less than; > means more than. Absence of an entry indicates that data were not available or were not estimated]

Map symbol and soil name	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	In/hr	In/in	pH	Mmhos/cm				Pct
1.* Arents										
2---------------- Benito	0-7	60-78	<0.06	0.07-0.14	7.9-9.0	4-16	Very high----	0.32	5	1-3
	7-65	60-78	<0.06	0.02-0.14	7.9-9.0	4-16	Very high----	0.32		
3, 4------------- Brennan	0-13	12-21	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low----------	0.24	5	<1
	13-65	18-30	0.6-2.0	0.12-0.17	7.4-8.4	<4	Low----------	0.32		
5, 6------------- Camargo	0-8	10-35	0.6-2.0	0.16-0.24	7.9-8.4	<2	Moderate-----	0.43	5	0.5-1
	8-65	18-35	0.6-2.0	0.15-0.24	7.9-8.4	<4	Moderate-----	0.43		
7---------------- Cameron	0-30	38-60	0.2-0.6	0.13-0.18	7.9-8.4	<4	High---------	0.32	5	1-3
	30-65	10-26	2.0-6.0	0.13-0.18	7.9-8.4	<4	Low----------	0.43		
8---------------- Comitas	0-28	2-12	2.0-6.0	0.05-0.10	6.1-7.3	<2	Low----------	0.17	5	<1
	28-80	16-24	2.0-6.0	0.11-0.17	6.1-8.4	<2	Low----------	0.24		
9---------------- Delfina	0-13	4-12	2.0-6.0	0.07-0.11	6.6-7.8	<2	Low----------	0.24	5	<1
	13-34	25-35	0.2-0.6	0.10-0.20	6.6-8.4	<4	Moderate-----	0.32		
	34-72	23-35	0.6-2.0	0.10-0.17	7.4-8.4	<4	Moderate-----	0.32		
10, 11----------- Delfina	0-13	7-20	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low----------	0.24	5	<1
	13-34	25-35	0.2-0.6	0.10-0.20	6.6-8.4	<4	Moderate-----	0.32		
	34-72	23-35	0.6-2.0	0.10-0.17	7.4-8.4	<4	Moderate-----	0.32		
12--------------- Delmita	0-13	5-14	2.0-6.0	0.07-0.11	6.6-7.8	<2	Low----------	0.24	3	<1
	13-34	18-30	0.6-2.0	0.12-0.15	6.6-7.8	<2	Low----------	0.28		
	34-60	---	---	---	---	---	-------------	----		
13:*										
Delmita----------	0-13	5-18	0.6-2.0	0.10-0.14	6.6-7.8	<2	Low----------	0.20	3	0.5-1
	13-34	18-30	0.6-2.0	0.12-0.15	6.6-7.8	<2	Low----------	0.28		
	34-60	---	---	---	---	---	-------------	----		
Randado----------	0-9	8-18	0.6-2.0	0.10-0.14	6.6-7.8	<2	Low----------	0.24	1	<1
	9-16	15-25	0.6-2.0	0.12-0.16	6.6-7.8	<2	Low----------	0.28		
	16-60	---	---	---	---	---	-------------	----		
14--------------- Falfurrias	0-80	1-9	6.0-20	0.02-0.08	6.1-7.8	<2	Very low-----	0.15	5	0.5-1
15--------------- Grulla	0-7	35-50	0.06-0.2	0.14-0.18	7.9-8.4	<4	High---------	0.32	5	0.5-1
	7-65	45-60	<0.06	0.12-0.18	7.9-8.4	<4	High---------	0.32		
16, 17, 18------- Hargill	0-18	10-16	2.0-6.0	0.10-0.15	6.6-7.8	<2	Low----------	0.24	5	1-3
	18-63	21-33	0.6-2.0	0.12-0.17	6.6-8.4	<2	Moderate-----	0.32		
	63-80	20-33	0.6-2.0	0.12-0.17	7.9-8.4	<2	Low----------	0.32		
19--------------- Harlingen	0-8	45-65	<0.06	0.12-0.18	7.9-8.4	2-4	Very high----	0.32	5	1-3
	8-35	60-76	<0.06	0.06-0.13	7.9-8.4	4-8	Very high----	0.32		
	35-72	50-76	<0.06	0.03-0.09	7.9-8.4	>4	Very high----	0.32		
20--------------- Harlingen	0-8	45-65	<0.06	0.03-0.09	7.9-8.4	4-16	Very high----	0.32	5	1-3
	8-35	60-76	<0.06	0.02-0.07	7.9-8.4	>8	Very high----	0.32		
	35-72	50-76	<0.06	0.02-0.05	7.9-8.4	>16	Very high----	0.32		
21:*										
Harlingen--------	0-8	45-65	<0.06	0.12-0.18	7.9-8.4	2-4	Very high----	0.32	5	1-3
	8-35	60-76	<0.06	0.06-0.13	7.9-8.4	4-8	Very high----	0.32		
	35-72	50-76	<0.06	0.03-0.09	7.9-8.4	>4	Very high----	0.32		
Urban land.										

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	In/hr	In/in	pH	Mmhos/cm				Pct
22, 23, 24-------Hebbronville	0-17	8-15	2.0-6.0	0.07-0.14	6.6-7.8	<2	Low----------	0.20	5	<1
	17-58	12-18	2.0-6.0	0.11-0.17	6.6-8.4	<2	Low----------	0.24		
	58-65	10-17	2.0-6.0	0.11-0.17	7.9-8.4	<2	Low----------	0.24		
25, 26, 27-------Hidalgo	0-17	15-20	0.6-2.0	0.08-0.15	7.9-8.4	<4	Low----------	0.24	5	1-3
	17-28	23-35	0.6-2.0	0.08-0.17	7.9-8.4	<4	Moderate-----	0.32		
	28-80	23-35	0.6-2.0	0.08-0.20	7.9-8.4	<4	Moderate-----	0.32		
28, 29-----------Hidalgo	0-17	20-30	0.6-2.0	0.08-0.17	7.9-8.4	<4	Moderate-----	0.32	5	1-3
	17-28	23-35	0.6-2.0	0.08-0.17	7.9-8.4	<4	Moderate-----	0.32		
	28-80	23-35	0.6-2.0	0.08-0.20	7.9-8.4	<4	Moderate-----	0.32		
30---------------Hidalgo	0-17	20-30	0.6-2.0	0.01-0.13	7.9-8.4	4-16	Moderate-----	0.32	5	1-3
	17-28	23-35	0.6-2.0	0.01-0.13	7.9-8.4	4-16	Moderate-----	0.32		
	28-80	23-35	0.6-2.0	0.01-0.15	7.9-9.0	4-16	Moderate-----	0.32		
31:*										
Hidalgo----------	0-17	20-30	0.6-2.0	0.08-0.17	7.9-8.4	<4	Moderate-----	0.32	5	1-3
	17-28	23-35	0.6-2.0	0.08-0.17	7.9-8.4	<4	Moderate-----	0.32		
	28-80	23-35	0.6-2.0	0.08-0.20	7.9-8.4	<4	Moderate-----	0.32		
Urban land.										
32:*										
Jimenez----------	0-8	12-24	0.6-2.0	0.05-0.10	7.9-8.4	<2	Low----------	0.10	1	1-3
	8-10	---	---	---	---	---	-------------	----		
	10-60	---	---	---	---	---	-------------	----		
Quemado----------	0-6	10-18	0.6-2.0	0.09-0.13	6.1-7.8	<2	Low----------	0.10	1	<1
	6-12	18-27	0.6-2.0	0.05-0.10	6.6-7.8	<2	Low----------	0.10		
	12-18	---	---	---	---	---	-------------	----		
	18-60	---	---	---	---	---	-------------	----		
33---------------Laredo	0-14	12-35	0.6-2.0	0.15-0.22	7.9-8.4	<2	Moderate-----	0.37	5	1-3
	14-65	18-35	0.6-2.0	0.13-0.20	7.9-8.4	<4	Moderate-----	0.43		
34---------------Matamoros	0-65	35-55	0.06-0.2	0.14-0.19	7.9-8.4	<4	Very high----	0.32	5	0.5-1
35, 36, 37, 38---McAllen	0-14	14-25	0.6-2.0	0.11-0.16	7.9-8.4	<2	Low----------	0.24	5	0.5-1
	14-72	20-31	0.6-2.0	0.09-0.18	7.9-8.4	<4	Low----------	0.28		
39---------------Mercedes	0-19	40-60	<0.06	0.12-0.18	7.9-8.4	<4	Very high----	0.32	5	1-3
	19-57	45-60	<0.06	0.09-0.15	7.9-9.0	<8	Very high----	0.32		
	57-65	45-60	<0.06	0.06-0.20	7.9-9.0	>4	Very high----	0.32		
40---------------Mercedes	0-19	40-60	<0.06	0.02-0.12	7.9-9.0	>4	Very high----	0.32	5	1-3
	19-57	45-60	<0.06	0.02-0.09	7.9-9.0	>8	Very high----	0.32		
	57-65	45-60	<0.06	0.02-0.07	7.9-9.0	>8	Very high----	0.32		
41---------------Mercedes	0-19	40-60	<0.06	0.12-0.18	7.9-8.4	<4	Very high----	0.32	5	1-3
	19-57	45-60	<0.06	0.09-0.15	7.9-9.0	<8	Very high----	0.32		
	57-65	45-60	<0.06	0.06-0.20	7.9-9.0	>4	Very high----	0.32		
42---------------Nueces	0-29	2-12	2.0-6.0	0.05-0.10	6.1-7.3	<2	Low----------	0.17	5	<1
	29-72	18-34	0.2-0.6	0.12-0.17	6.6-8.4	<2	Moderate-----	0.24		
43:*										
Nueces-----------	0-29	2-12	2.0-6.0	0.05-0.10	6.1-7.3	<2	Low----------	0.17	5	<1
	29-72	18-34	0.2-0.6	0.12-0.17	6.6-8.4	<2	Moderate-----	0.24		
Sarita-----------	0-48	1-10	6.0-20	0.05-0.10	6.1-7.3	<2	Low----------	0.17	5	0.5-1
	48-80	18-35	2.0-6.0	0.13-0.19	5.6-8.4	<2	Moderate-----	0.24		
44---------------Olmito	0-47	35-55	0.2-0.6	0.13-0.18	7.9-8.4	<4	Very high----	0.32	5	1-3
	47-65	35-55	0.06-0.2	0.06-0.18	7.9-8.4	>4	Very high----	0.32		
45,* 46,* 47.* Pits										

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	In/hr	In/in	pH	Mmhos/cm				Pct
48--------------- Racombes	0-13	16-28	0.6-2.0	0.14-0.19	6.6-7.8	<2	Low----------	0.28	5	1-3
	13-49	25-34	0.6-2.0	0.15-0.20	6.6-8.4	<4	Moderate-----	0.32		
	49-72	26-34	0.6-2.0	0.15-0.20	7.9-8.4	<4	Low----------	0.32		
49--------------- Racombes	0-13	16-28	0.6-2.0	0.04-0.12	6.6-7.8	4-16	Low----------	0.28	5	1-3
	13-49	26-34	0.6-2.0	0.04-0.13	6.6-8.4	4-16	Moderate-----	0.32		
	49-72	25-34	0.6-2.0	0.04-0.13	7.9-8.4	>4	Moderate-----	0.32		
50--------------- Ramadero	0-21	16-34	0.6-2.0	0.14-0.19	6.6-8.4	<2	Moderate-----	0.28	5	1-3
	21-65	25-34	0.6-2.0	0.15-0.20	6.6-8.4	<4	Moderate-----	0.32		
51:*										
Randado----------	0-9	8-18	0.6-2.0	0.10-0.14	6.6-7.8	<2	Low----------	0.24	1	<1
	9-16	15-25	0.6-2.0	0.12-0.16	6.6-7.8	<2	Low----------	0.28		
	16-60	---	---	---	---	---	-------------	----		
Cuevitas---------	0-8	7-18	0.6-2.0	0.10-0.14	6.6-7.8	<2	Low----------	0.20	1	0.5-1
	8-60	---	---	---	---	---	-------------	----		
52--------------- Raymondville	0-15	32-42	0.2-0.6	0.12-0.18	7.9-8.4	<4	High---------	0.32	5	1-3
	15-43	35-50	0.06-0.2	0.10-0.18	7.9-8.4	<4	High---------	0.32		
	43-65	35-45	0.06-0.2	0.10-0.18	7.9-8.4	<4	High---------	0.32		
53--------------- Raymondville	0-15	32-42	0.2-0.6	0.04-0.11	7.9-8.4	4-16	High---------	0.28	5	1-3
	15-43	35-50	0.06-0.2	0.04-0.11	7.9-8.4	4-16	High---------	0.28		
	43-65	35-45	0.06-0.2	0.04-0.11	7.9-8.4	>4	High---------	0.32		
54:*										
Raymondville-----	0-15	32-42	0.2-0.6	0.12-0.18	7.9-8.4	<4	High---------	0.32	5	1-3
	15-43	35-50	0.06-0.2	0.10-0.18	7.9-8.4	<4	High---------	0.32		
	43-65	35-45	0.06-0.2	0.10-0.18	7.9-8.4	<4	High---------	0.32		
Urban land.										
55--------------- Reynosa	0-15	15-30	0.6-2.0	0.18-0.24	7.9-8.4	<2	Moderate-----	0.37	5	0.5-1
	15-48	18-35	0.6-2.0	0.15-0.24	7.9-8.4	<4	Moderate-----	0.43		
	48-65	18-35	0.6-2.0	0.12-0.22	7.9-8.4	<4	Low----------	0.43		
56--------------- Reynosa	0-15	15-30	0.6-2.0	0.05-0.15	7.9-8.4	4-16	Moderate-----	0.37	5	0.5-1
	15-48	18-35	0.6-2.0	0.04-0.14	7.9-8.4	4-16	Moderate-----	0.43		
	48-65	18-35	0.6-2.0	0.04-0.14	7.9-8.4	4-16	Low----------	0.43		
57:*										
Reynosa----------	0-15	15-30	0.6-2.0	0.18-0.24	7.9-8.4	<2	Moderate-----	0.37	5	0.5-1
	15-48	18-35	0.6-2.0	0.15-0.24	7.9-8.4	<4	Moderate-----	0.43		
	48-65	18-35	0.6-2.0	0.12-0.22	7.9-8.4	<4	Low----------	0.43		
Urban land.										
58--------------- Rio	0-12	12-20	2.0-6.0	0.14-0.18	6.6-7.8	<4	Low----------	0.24	5	1-3
	12-38	35-50	0.06-0.2	0.13-0.18	7.4-8.4	<4	Moderate-----	0.32		
	38-63	30-40	0.2-0.6	0.12-0.17	7.9-8.4	<4	Moderate-----	0.32		
59--------------- Rio	0-12	12-20	2.0-6.0	0.04-0.12	6.6-7.8	4-16	Low----------	0.24	5	1-3
	12-38	35-50	0.06-0.2	0.04-0.11	7.4-8.4	4-16	Moderate-----	0.32		
	38-63	30-40	0.2-0.6	0.04-0.10	7.9-8.4	>4	Moderate-----	0.32		
60--------------- Rio	0-12	20-35	0.6-2.0	0.15-0.20	6.6-7.8	<4	Moderate-----	0.32	5	1-3
	12-38	35-50	0.06-0.2	0.13-0.18	7.4-8.4	<4	Moderate-----	0.32		
	38-63	30-40	0.2-0.6	0.12-0.17	7.9-8.4	<4	Moderate-----	0.32		
61--------------- Rio	0-12	20-35	0.6-2.0	0.04-0.12	6.6-7.8	4-16	Moderate-----	0.32	5	1-3
	12-38	35-50	0.06-0.2	0.04-0.11	7.4-8.4	4-16	Moderate-----	0.32		
	38-63	30-40	0.2-0.6	0.04-0.10	7.9-8.4	>4	Moderate-----	0.32		
62--------------- Rio Grande	0-8	9-18	2.0-6.0	0.13-0.24	7.9-8.4	<4	Low----------	0.49	5	0.5-1
	8-65	9-18	2.0-6.0	0.13-0.24	7.9-8.4	<4	Low----------	0.49		

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	In/hr	In/in	pH	Mmhos/cm				Pct
63---------------- Rio Grande	0-8	28-35	0.6-2.0	0.18-0.24	7.9-8.4	<4	Moderate-----	0.49	5	0.5-1
	8-65	9-18	2.0-6.0	0.13-0.24	7.9-8.4	<4	Low----------	0.49		
64---------------- Runn	0-55	36-55	0.06-0.2	0.13-0.20	7.9-8.4	<4	High---------	0.32	5	0.5-1
	55-65	24-55	0.2-0.6	0.09-0.20	7.9-8.4	<8	Moderate-----	0.37		
65---------------- Runn	0-55	36-55	0.06-0.2	0.03-0.15	7.9-8.4	4-16	High---------	0.32	5	0.5-1
	55-65	24-55	0.2-0.6	0.03-0.15	7.9-8.4	4-16	Moderate-----	0.37		
66---------------- Sarita	0-48	1-13	6.0-20	0.05-0.10	6.1-7.3	<2	Low----------	0.17	5	0.5-1
	48-80	18-35	2.0-6.0	0.13-0.19	5.6-8.4	<2	Moderate-----	0.24		
67---------------- Tiocano	0-65	40-60	<0.06	0.12-0.18	7.4-8.4	<4	Very high----	0.32	5	1-3
68.* Urban land										
69.* Ustorthents										
70, 71------------ Willacy	0-14	12-22	2.0-6.0	0.14-0.18	6.6-7.8	<4	Low----------	0.24	5	1-3
	14-80	18-27	0.6-2.0	0.14-0.18	7.4-8.4	<4	Low----------	0.32		
72:* Willacy---------	0-14	12-22	2.0-6.0	0.14-0.18	6.6-7.8	<4	Low----------	0.24	5	1-3
	14-80	18-27	0.6-2.0	0.14-0.18	7.4-8.4	<4	Low----------	0.32		
Urban land.										
73---------------- Zalla	0-9	2-14	6.0-20	0.05-0.09	7.8-8.4	<2	Low----------	0.17	5	<.5
	9-65	2-14	6.0-20	0.05-0.09	7.8-8.4	<2	Low----------	0.17		
74---------------- Zalla	0-9	8-18	2.0-6.0	0.13-0.20	7.8-8.4	<2	Low----------	0.17	5	<.5
	9-65	2-14	6.0-20	0.05-0.09	7.8-8.4	<2	Low----------	0.17		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Map symbol and soil name	Hydrologic group	Flooding			High water table			Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
1.* Arents											
2 Benito	D	Occasional	Long	Sep-May	4.0-6.0	Apparent	Sep-May	---	---	High	Low.
3, 4 Brennan	B	None	---	---	>6.0	---	---	---	---	Moderate	Low.
5, 6 Camargo	B	Rare	Brief	Sep-May	>6.0	---	---	---	---	Moderate	Low.
7 Cameron	D	None	---	---	5.0-6.0	Apparent	Sep-May	---	---	High	Low.
8 Comitas	A	None	---	---	>6.0	---	---	---	---	Low	Low.
9, 10, 11 Delfina	B	None	---	---	2.5-5.0	Apparent	Sep-May	---	---	High	Low.
12 Delmita	C	None	---	---	>6.0	---	---	20-40	Thin	Moderate	Low.
13:*											
Delmita	C	None	---	---	>6.0	---	---	20-40	Thin	Moderate	Low.
Randado	C	None	---	---	>6.0	---	---	8-20	Thin	Moderate	Low.
14 Falfurrias	A	None	---	---	>6.0	---	---	---	---	Low	Low.
15** Grulla	D	Frequent	Very long	Sep-May	+2-6.0	Apparent	Sep-May	---	---	High	Low.
16, 17, 18 Hargill	B	None	---	---	>6.0	---	---	---	---	High	Low.
19 Harlingen	D	None	---	---	>6.0	---	---	---	---	High	Low.
20 Harlingen	D	None	---	---	5.0-6.0	---	---	---	---	High	Moderate.
21:*											
Harlingen	D	None to rare	---	---	>6.0	---	---	---	---	High	Low.
Urban land.											
22, 23, 24 Hebbronville	B	None	---	---	>6.0	---	---	---	---	Low	Low.
25, 26, 27, 28, 29 Hidalgo	B	None	---	---	>6.0	---	---	---	---	High	Low.
30 Hidalgo	B	None	---	---	2.5-5.0	Apparent	Sep-May	---	---	High	Low.
31:*											
Hidalgo	B	None	---	---	>6.0	---	---	---	---	High	Low.
Urban land.											
32:*											
Jimenez	C	None	---	---	>6.0	---	---	7-20	Thin	High	Low.

See footnotes at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table			Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
32:*											
Quemado	C	None	---	---	>6.0	---	---	10-20	Thin	Moderate	Low.
33 Laredo	B	None	---	---	>6.0	---	---	---	---	High	Low.
34 Matamoros	C	Occasional	Long	Sep-May	>6.0	---	---	---	---	High	Low.
35, 36, 37, 38 McAllen	C	None	---	---	>6.0	---	---	---	---	High	Low.
39, 40, 41 Mercedes	D	None	---	---	>6.0	---	---	---	---	High	Low.
42 Nueces	C	None	---	---	>6.0	---	---	---	---	Moderate	Low.
43:*											
Nueces	C	None	---	---	>6.0	---	---	---	---	Moderate	Low.
Sarita	A	None	---	---	>6.0	---	---	---	---	Low	Low.
44, 44 Olmito	D	None	---	---	>6.0	---	---	---	---	High	Low.
45,* 46,* 47.* Pits											
48 Racombes	B	Rare	---	---	>6.0	---	---	---	---	High	Low.
49 Racombes	B	Rare	---	---	1.5-4.5	Apparent	Sep-May	---	---	High	Low.
50 Ramadero	B	Common	Brief	Sep-May	>6.0	---	---	---	---	High	Low.
51:*											
Randado	C	None	---	---	>6.0	---	---	8-20	Thin	Moderate	Low.
Cuevitas	D	None	---	---	>6.0	---	---	8-14	Thin	Moderate	Low.
52 Raymondville	D	None	---	---	>6.0	---	---	---	---	High	Low.
53 Raymondville	D	None	---	---	2.5-4.5	Apparent	Sep-May	---	---	High	Low.
54:*											
Raymondville	D	None	---	---	>6.0	---	---	---	---	High	Low.
Urban land.											
55 Reynosa	B	None	---	---	>6.0	---	---	---	---	High	Low.
56 Reynosa	B	None	---	---	1.5-4.5	Apparent	Sep-May	---	---	High	Low.
57:*											
Reynosa	B	None	---	---	>6.0	---		---	---	High	Low.
Urban land.											
58** Rio	D	Frequent	Long	Sep-May	+2-6.0	Apparent	Sep-May	---	---	High	Low.
59** Rio	D	Frequent	Long	Sep-May	+2-4.5	Apparent	Sep-May	---	---	High	Low.

See footnotes at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table			Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
60**: Rio	D	Frequent	Long	Sep-May	+2-6.0	Apparent	Sep-May	---	---	High	Low.
61**: Rio	D	Frequent	Long	Sep-May	+2-4.5	Apparent	Sep-May	---	---	High	Low.
62, 63: Rio Grande	B	Rare	Brief	Sep-May	>6.0	---	---	---	---	High	Low.
64: Runn	D	None	---	---	>6.0	---	---	---	---	High	Low.
65: Runn	D	None	---	---	2.5-5.0	Apparent	Sep-May	---	---	High	Low.
66: Sarita	A	None	---	---	>6.0	---	---	---	---	Low	Low.
67**: Tiocano	D	Frequent	Long	Sep-May	+3-6.0	Perched	Sep-May	---	---	High	Low.
68.* Urban land											
69.* Ustorthents											
70, 71: Willacy	B	None	---	---	>6.0	---	---	---	---	Moderate	Low.
72:*											
Willacy	B	None	---	---	>6.0	---	---	---	---	Moderate	Low.
Urban land.											
73: Zalla	A	Occasional	Brief	Sep-May	>6.0	---	---	---	---	High	Low.
74: Zalla	A	Rare	Brief	Sep-May	>6.0	---	---	---	---	High	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.
** In the "High water table--Depth" column, a plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

TABLE 19.--ENGINEERING INDEX TEST DATA

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution: Percentage passing sieve--					Percentage smaller than--			Liquid limit[1]	Plasticity index[1]	Specific gravity	Shrinkage		
	AASHTO	Unified	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm				Limit	Linear	Ratio
											Pct		G/cc	Pct	Pct	Pct
Brennan fine sandy loam:[2] (S73TX-108-003)																
A1--------7 to 14	A-4 (00)	SM-SC	100	100	100	100	43	32	18	15	23	7	2.66	16.0	3.8	1.81
B2t------14 to 32	A-6 (03)	SC	100	100	100	100	47	36	22	21	29	14	2.66	17.0	6.4	1.81
Cca------45 to 70	A-6 (10)	CL	100	100	100	100	59	50	31	25	36	22	2.66	19.0	8.6	1.77
Delfina loamy fine sand:[3] (S73TX-108-001)																
A12-------6 to 13	A-2-4(00)	SM	100	100	100	100	27	20	9	8	19	3	2.63	16.0	2.0	1.81
B21t-----13 to 21	A-6 (06)	SC	100	100	100	100	46	42	31	30	37	23	2.65	16.0	10.0	1.81
B23tca---37 to 49	A-7-6(10)	SC	100	99	98	97	48	43	32	31	46	31	2.67	17.0	12.8	1.81
Hargill fine sandy loam:[4] (S73TX-108-002)																
A1--------6 to 12	A-2-4(00)	SM	100	100	100	100	17	12	7	7	20	3	2.64	18.0	1.8	1.71
B21t-----12 to 30	A-6 (03)	SC	100	100	100	100	41	34	25	25	33	19	2.65	18.0	7.8	1.76
B23t-----44 to 60	A-2-6(01)	SC	100	100	100	100	35	30	21	20	29	14	2.65	18.0	6.0	1.77
Hidalgo sandy clay loam:[5] (S73TX-108-006)																
Ap--------0 to 9	A-6 (05)	CL	100	100	100	99	54	45	28	23	29	15	2.67	16.0	7.2	1.84
B2-------17 to 28	A-6 (11)	CL	100	100	99	99	68	61	40	33	35	20	2.67	14.0	10.4	1.88
Cca------38 to 65	A-6 (16)	CL	100	100	99	99	77	71	50	40	39	23	2.68	13.0	12.5	1.94
Matamoros silty clay:[6] (S73TX-108-008)																
Ap--------0 to 12	A-7-6(37)	CH	100	100	100	100	100	95	68	51	57	32	2.69	18.0	15.7	1.75
C2-------26 to 33	A-7-6(47)	CH	100	100	100	100	100	98	83	64	64	41	2.70	16.0	19.4	1.87
McAllen fine sandy loam:[7] (S73TX-108-009)																
A12-------6 to 14	A-4 (02)	CL	100	100	99	99	55	44	22	17	25	9	2.64	16.0	4.8	1.86
B2-------14 to 37	A-6 (07)	CL	100	100	99	98	64	54	29	23	31	15	2.68	17.0	6.8	1.79
Cca------37 to 72	A-6 (10)	CL	100	98	91	89	67	59	37	28	34	18	2.69	18.0	8.0	1.78
Mercedes clay:[8] (S73TX-108-005)																
A12-------8 to 19	A-7-6(30)	CH	100	100	100	100	84	81	70	57	53	35	2.67	12.0	18.4	2.01
AC-------30 to 57	A-7-6(27)	CL-CH	100	100	100	100	82	79	67	56	50	33	2.72	12.0	17.4	2.01
C--------57 to 65	A-7-6(25)	CL	100	100	100	100	80	77	63	51	48	32	2.70	11.0	17.2	2.07

See footnotes at end of table.

TABLE 19.--ENGINEERING INDEX TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution								Liquid limit[1]	Plasticity index[1]	Specific gravity	Shrinkage		
			Percentage passing sieve--					Percentage smaller than--								
	AASHTO	Unified	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm				Limit	Linear	Ratio
											Pct		G/cc	Pct	Pct	Pct
Reynosa silty clay loam:[9] (S73TX-108-007)																
A12-------7 to 14	A-7-6(27)	CL	100	100	100	100	98	91	51	36	45	25	2.67	19.0	12.2	1.78
B2ca-----14 to 47	A-7-6(24)	CL	100	100	100	100	98	91	51	37	43	23	2.67	17.0	12.3	1.81
C--------47 to 73	A-7-6(32)	CL	100	100	100	100	99	96	60	43	49	29	2.71	17.0	14.3	1.85
Rio Grande silt loam:[10] (S73TX-108-011)																
Ap--------0 to 8	A-4 (05)	CL	100	100	100	100	78	66	21	17	29	8	2.64	19.0	5.0	1.73
C1--------8 to 36	A-4 (11)	CL	100	100	100	100	99	86	23	18	33	10	2.66	22.0	5.4	1.66
Runn silty clay:[11] (S73TX-108-010)																
A1--------8 to 18	A-7-6(30)	CL	100	100	100	100	96	93	66	48	48	29	2.69	14.0	15.3	1.92
B22------28 to 41	A-7-6(30)	CL	100	100	100	100	96	93	64	48	48	29	2.67	15.0	15.0	1.92
Cca------41 to 65	A-7-6(30)	CL	100	100	100	100	95	93	62	47	48	30	2.69	16.0	14.7	1.90

[1]Liquid limit and plasticity index values were determined by the AASHTO-89 and AASHTO-90 methods except that soil was added to water.

[2]Brennan fine sandy loam:
2.3 miles north of courthouse in Edinburg on U.S. 281, 3.7 miles west on Farm Road 1925, then 3.1 miles north and 1.05 miles west.

[3]Delfina loamy fine sand:
2.3 miles south of San Manuel on U.S. 281, 200 feet east on private road and 25 feet south.

[4]Hargill fine sandy loam:
2.65 miles east on Farm Road 2812 from junction of Farm Road 2812 and U.S. 281, then 100 feet north.

[5]Hidalgo sandy clay loam:
1.1 miles west of junction of Main Street in Donna and U.S. 83, 0.6 mile north and 250 feet west of county road.

[6]Matamoros silty clay:
7 miles south of junction of Farm Road 2557 and U.S. 83, 0.5 mile south and 0.4 mile east on levee, 0.5 mile south and 100 feet east.

[7]McAllen fine sandy loam:
3.3 miles south of McCook on Farm Road 2058, then 100 feet west.

[8]Mercedes clay:
4.1 miles south of junction of Farm Road 1015 and Texas 107, 1 mile east and 0.2 mile north, 100 feet west of road.

[9]Reynosa silty clay loam:
0.6 mile west of junction of U.S. 281 and Farm Road 493, 0.7 mile south and 0.25 mile west, 50 feet north.

[10]Rio Grande silt loam:
0.1 mile north of bridge at Hidalgo, then 0.5 mile northwest and 0.7 mile southwest on field road and 50 feet south.

[11]Runn silty clay:
2.5 miles south of the junction of Texas 336 and U.S. 83, 300 feet west, and 300 feet north.

TABLE 20.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Benito	Very-fine, montmorillonitic, hyperthermic Udorthentic Pellusterts
Brennan	Fine-loamy, mixed, hyperthermic Aridic Haplustalfs
Camargo	Fine-silty, mixed (calcareous), hyperthermic Typic Ustifluvents
Cameron	Clayey over loamy, mixed, hyperthermic Vertic Haplustolls
Comitas	Loamy, mixed, hyperthermic Arenic Aridic Paleustalfs
Cuevitas	Loamy, mixed, hyperthermic, shallow Ustollic Paleorthids
Delfina	Fine-loamy, mixed, hyperthermic Aquic Paleustalfs
Delmita	Fine-loamy, mixed, hyperthermic Petrocalcic Paleustalfs
Falfurrias	Mixed, hyperthermic Typic Ustipsamments
Grulla	Fine, mixed (calcareous), hyperthermic Vertic Fluvaquents
Hargill	Fine-loamy, mixed, hyperthermic Udic Paleustolls
Harlingen	Very-fine, montmorillonitic, hyperthermic Entic Chromusterts
Hebbronville	Coarse-loamy, mixed, hyperthermic Aridic Haplustalfs
Hidalgo	Fine-loamy, mixed, hyperthermic Typic Calciustolls
Jimenez	Loamy-skeletal, mixed, hyperthermic, shallow Petrocalcic Calciustolls
Laredo	Fine-silty, mixed, hyperthermic Fluventic Haplustolls
Matamoros	Fine, mixed (calcareous), hyperthermic Vertic Ustifluvents
McAllen	Fine-loamy, mixed, hyperthermic Aridic Ustochrepts
Mercedes	Fine, montmorillonitic, hyperthermic Udorthentic Pellusterts
Nueces	Loamy, mixed, hyperthermic Aquic Arenic Paleustalfs
Olmito	Fine, montmorillonitic, hyperthermic Vertic Calciustolls
Quemado	Loamy-skeletal, mixed, hyperthermic, shallow Petrocalcic Ustalfic Paleargids
Racombes	Fine-loamy, mixed, hyperthermic Pachic Argiustolls
Ramadero	Fine-loamy, mixed, hyperthermic Cumulic Haplustolls
Randado	Loamy, mixed, hyperthermic, shallow Petrocalcic Ustollic Paleargids
Raymondville	Fine, mixed, hyperthermic Vertic Calciustolls
Reynosa	Fine-silty, mixed, hyperthermic Fluventic Ustochrepts
Rio	Fine, mixed, hyperthermic Typic Argiaquolls
Rio Grande	Coarse-silty, mixed (calcareous), hyperthermic Typic Ustifluvents
Runn	Fine, mixed, hyperthermic Vertic Ustochrepts
Sarita	Loamy, mixed, hyperthermic Grossarenic Paleustalfs
Tiocano	Fine, montmorillonitic, hyperthermic Udic Pellusterts
Willacy	Fine-loamy, mixed, hyperthermic Udic Argiustolls
Zalla	Sandy, mixed, hyperthermic Typic Ustifluvents

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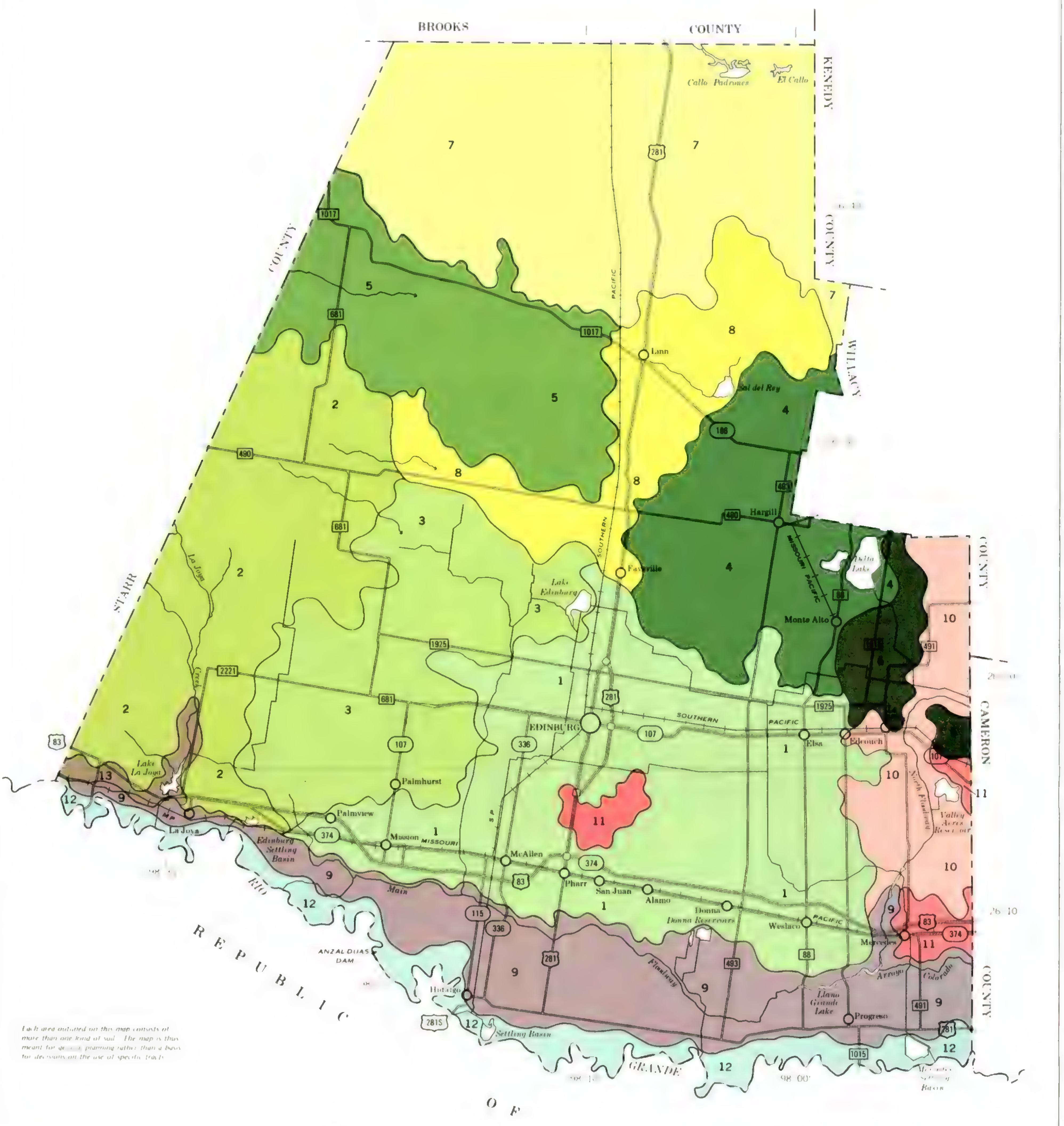


LEGEND

DOMINANTLY NEARLY LEVEL TO GENTLY SLOPING LOAMY SOILS ON UPLANDS

1 Hidalgo. Deep, moderately permeable soils that typically have a dark grayish brown sandy clay loam surface layer

2 McAllen-Brennan. Deep, moderately permeable soils that typically have a light brownish gray or dark brown fine sandy loam surface layer

3 Brennan-Hidalgo. Deep, moderately permeable soils that typically have a dark brown or dark grayish brown fine sandy loam surface layer

4 Willacy-Delfina-Hargill. Deep, moderately and moderately slowly permeable soils that typically have a dark grayish brown, grayish brown, or brown fine sandy loam surface layer

5 Delmita-Randado. Moderately deep and shallow, moderately permeable soils that typically have a reddish brown fine sandy loam or loamy fine sand surface layer

6 Willacy-Racombes. Deep, moderately permeable soils that typically have a dark grayish brown or very dark gray fine sandy loam or sandy clay loam surface layer

DOMINANTLY NEARLY LEVEL TO GENTLY SLOPING SANDY SOILS ON UPLANDS

7 Nueces-Sarita. Deep, moderately slowly and moderately rapidly permeable soils that typically have a brown or light brownish gray fine sand surface layer

8 Delfina-Hebbronville-Comitas. Deep, moderately slowly and moderately rapidly permeable soils that typically have a brown loamy fine sand or sandy loam surface layer

DOMINANTLY NEARLY LEVEL, CLAYEY AND LOAMY SOILS ON TERRACES

9 Harlingen-Runn-Reynosa. Deep, very slowly, slowly, and moderately permeable soils that typically have a grayish brown clay, silty clay, or silty clay loam surface layer

DOMINANTLY NEARLY LEVEL, LOAMY AND CLAYEY SOILS ON UPLANDS

10 Raymondville-Mercedes. Deep, slowly and very slowly permeable soils that typically have a gray clay loam or clay surface layer

11 Raymondville-Hidalgo. Deep, slowly and moderately permeable soils that typically have a gray or dark grayish brown clay loam or sandy clay loam surface layer

DOMINANTLY NEARLY LEVEL, LOAMY AND CLAYEY SOILS ON BOTTOM LANDS

12 Rio Grande-Matamoros. Deep, moderately and slowly permeable soils that typically have a light brownish gray or grayish brown silt loam or silty clay surface layer

DOMINANTLY PITS AND GENTLY SLOPING TO SLOPING, GRAVELLY, LOAMY SOILS ON UPLANDS

13 Pits-Jimenez-Quemado. Gravel pits and very shallow to shallow, moderately permeable soils that typically have a brown or dark brown very gravelly loam or very gravelly sandy loam surface layer

N

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION

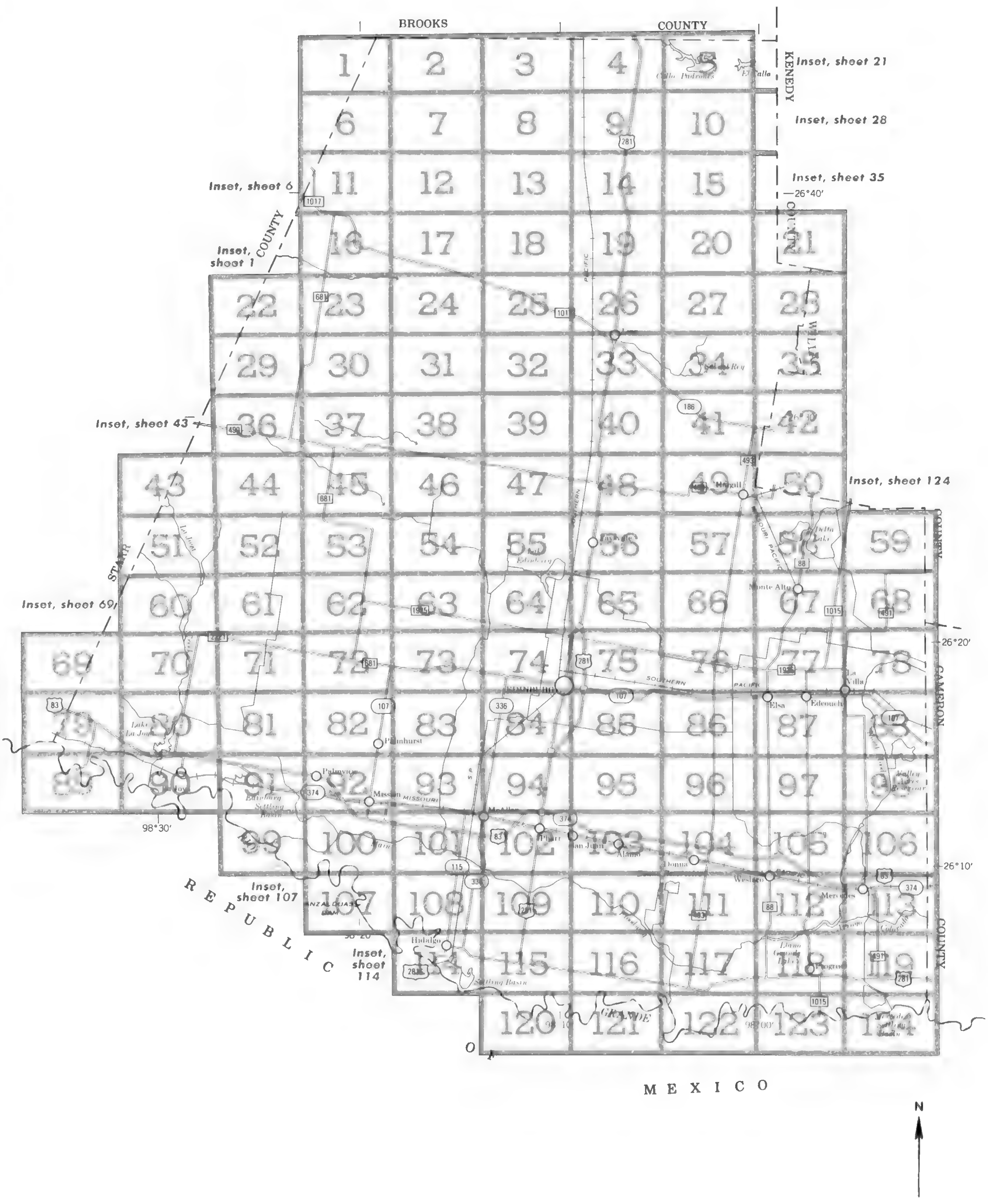
GENERAL SOIL MAP

HIDALGO COUNTY, TEXAS

Scale 1:316,800

1 0 1 2 3 4 5 Miles

1 0 5 10 Km



INDEX TO MAP SHEETS

HIDALGO COUNTY, TEXAS

Scale 1:316,800

1 0 1 2 3 4 5 Miles

1 0 5 10 Km

SOIL LEGEND

The legend is numeric, and the map unit names are in alphabetical order. Soil names that do not give a slope range are for nearly level soils.

SYMBOL	NAME
1	Arents, loamy
2	Benito clay
3	Brennan fine sandy loam, 0 to 1 percent slopes
4	Brennan fine sandy loam, 1 to 3 percent slopes
5	Camargo silt loam
6	Camargo silty clay loam
7	Cameron silty clay
8	Comitas loamy fine sand, 0 to 3 percent slopes
9	Delfina loamy fine sand, 0 to 3 percent slopes
10	Delfina fine sandy loam, 0 to 1 percent slopes
11	Delfina fine sandy loam, 1 to 3 percent slopes
12	Delmita loamy fine sand, 0 to 3 percent slopes
13	Delmita-Randado complex, 0 to 1 percent slopes
14	Falfurrias fine sand, 0 to 5 percent slopes
15	Grulla clay
16	Hargill fine sandy loam, 0 to 1 percent slopes
17	Hargill fine sandy loam, 1 to 3 percent slopes
18	Hargill fine sandy loam, 3 to 5 percent slopes
19	Harlingen clay
20	Harlingen clay, saline
21	Harlingen-Urban land complex
22	Hebbronville sandy loam, 0 to 1 percent slopes
23	Hebbronville sandy loam, 1 to 3 percent slopes
24	Hebbronville sandy loam, 3 to 5 percent slopes
25	Hidalgo fine sandy loam, 0 to 1 percent slopes
26	Hidalgo fine sandy loam, 1 to 3 percent slopes
27	Hidalgo fine sandy loam, 3 to 5 percent slopes
28	Hidalgo sandy clay loam, 0 to 1 percent slopes
29	Hidalgo sandy clay loam, 1 to 3 percent slopes
30	Hidalgo sandy clay loam, saline, 0 to 1 percent slopes
31	Hidalgo-Urban land complex, 0 to 3 percent slopes
32	Jimenez-Quemado complex, 1 to 8 percent slopes
33	Laredo silty clay loam
34	Matamoros silty clay
35	McAllen fine sandy loam, 0 to 1 percent slopes
36	McAllen fine sandy loam, 1 to 3 percent slopes
37	McAllen fine sandy loam, 3 to 5 percent slopes
38	McAllen sandy clay loam, 0 to 1 percent slopes
39	Mercedes clay, 0 to 1 percent slopes
40	Mercedes clay, saline, 0 to 1 percent slopes
41	Mercedes clay, 1 to 5 percent slopes, gullied
42	Nueces fine sand, 0 to 3 percent slopes
43	Nueces-Sarita complex, 0 to 3 percent slopes
44	Olmito silty clay
45	Pits, borrow
46	Pits, caliche
47	Pits, gravel
48	Racombes sandy clay loam
49	Racombes sandy clay loam, saline
50	Ramadero sandy clay loam
51	Randado-Cuevitas complex, 0 to 3 percent slopes
52	Raymondville clay loam
53	Raymondville clay loam, saline
54	Raymondville-Urban land complex
55	Reynosa silty clay loam
56	Reynosa silty clay loam, saline
57	Reynosa-Urban land complex
58	Rio fine sandy loam
59	Rio fine sandy loam, saline
60	Rio clay loam
61	Rio clay loam, saline
62	Rio Grande silt loam
63	Rio Grande silty clay loam
64	Runn silty clay
65	Runn silty clay, saline
66	Sarita fine sand, 0 to 3 percent slopes
67	Tiocano clay
68	Urban land
69	Ustorthents, loamy
70	Willacy fine sandy loam, 0 to 1 percent slopes
71	Willacy fine sandy loam, 1 to 3 percent slopes
72	Willacy-Urban land complex, 0 to 3 percent slopes
73	Zalla loamy fine sand, undulating
74	Zalla silt loam

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate
- Federal
- State
- County, farm or ranch

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label)
- Located object (label)
- Tank (label)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial
- Intermittent

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

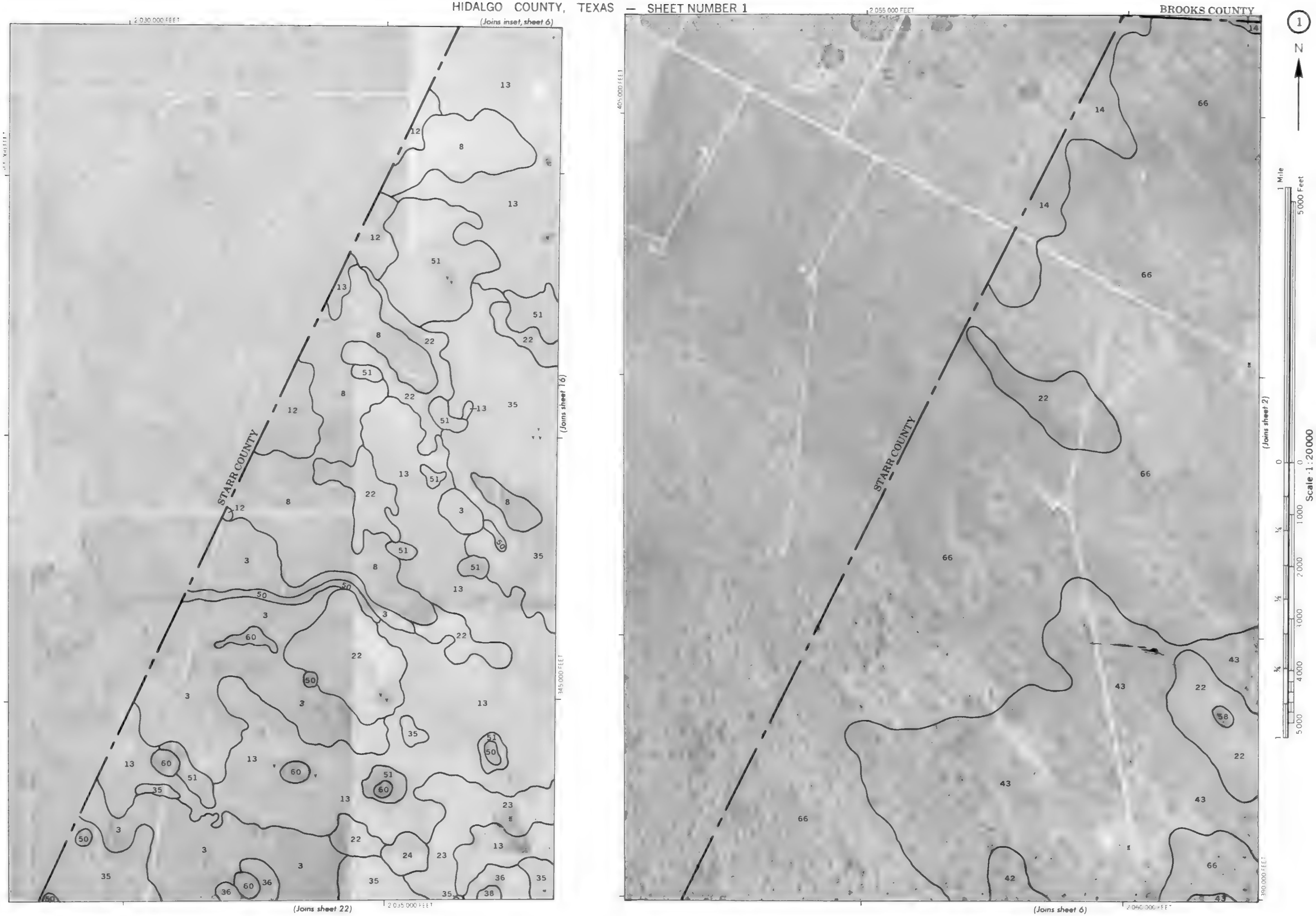
GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Cut area < 3 acres
- Fill area < 3 acres



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HIDALGO COUNTY, TEXAS — SHEET NUMBER 2

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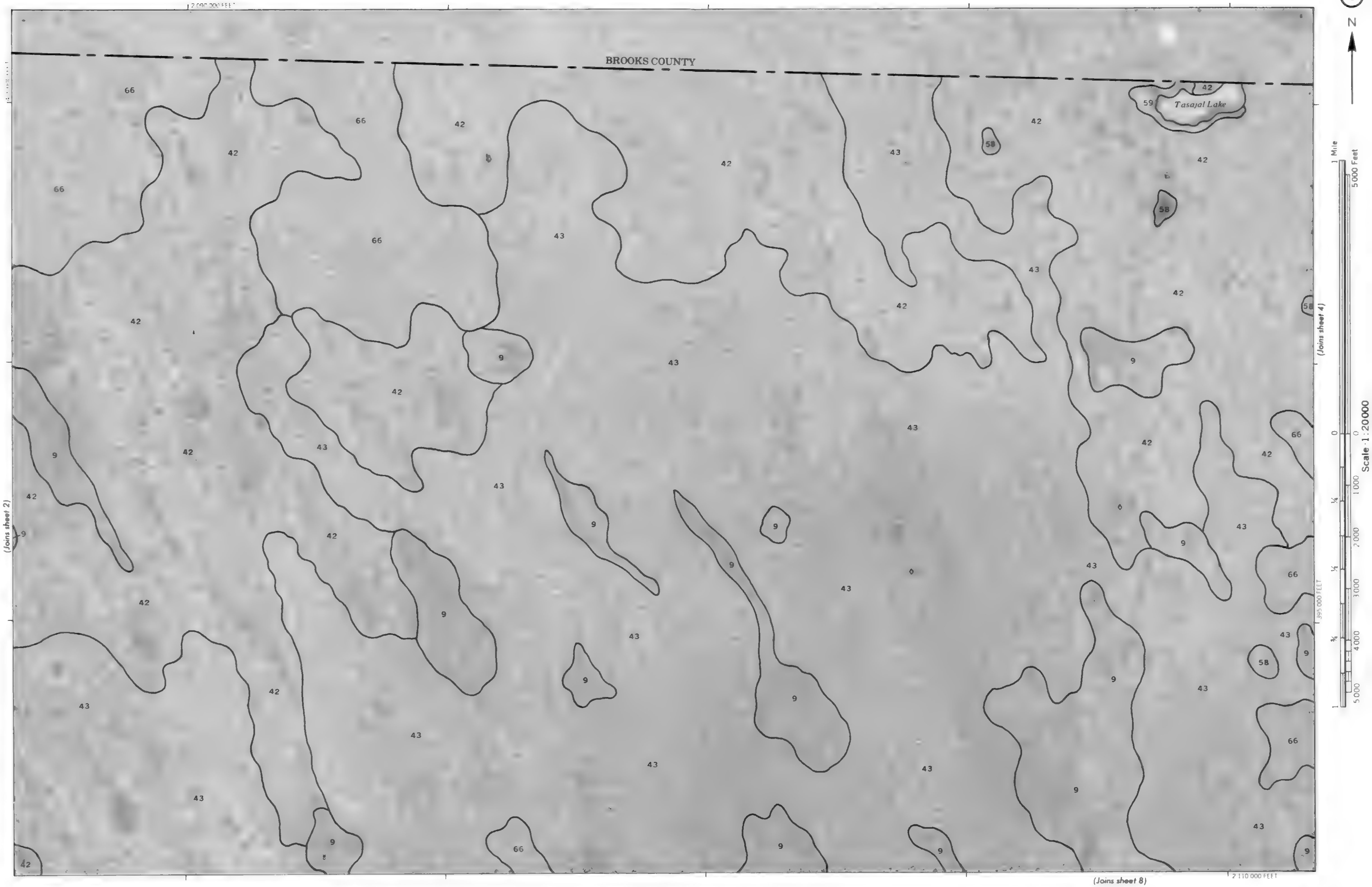

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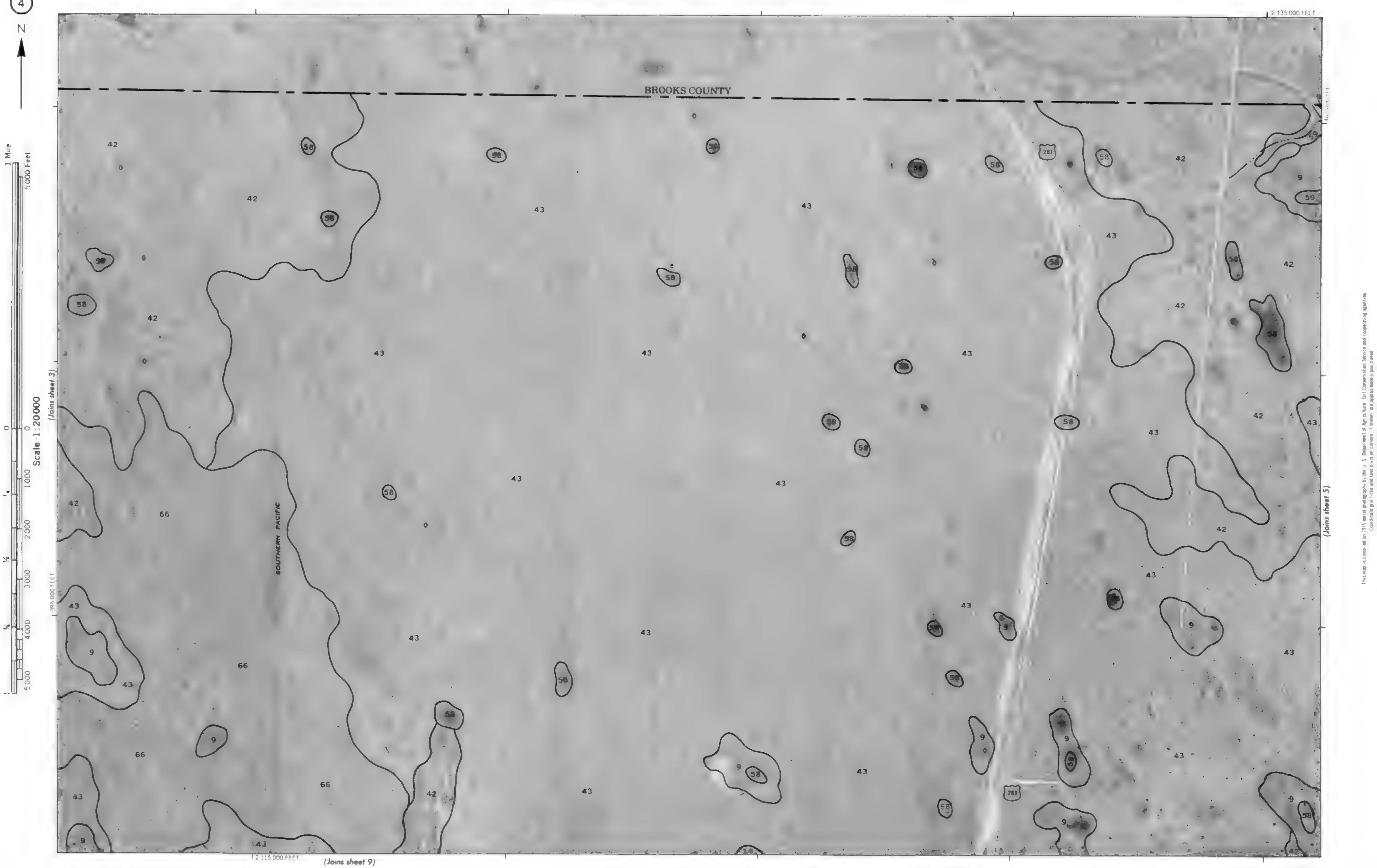
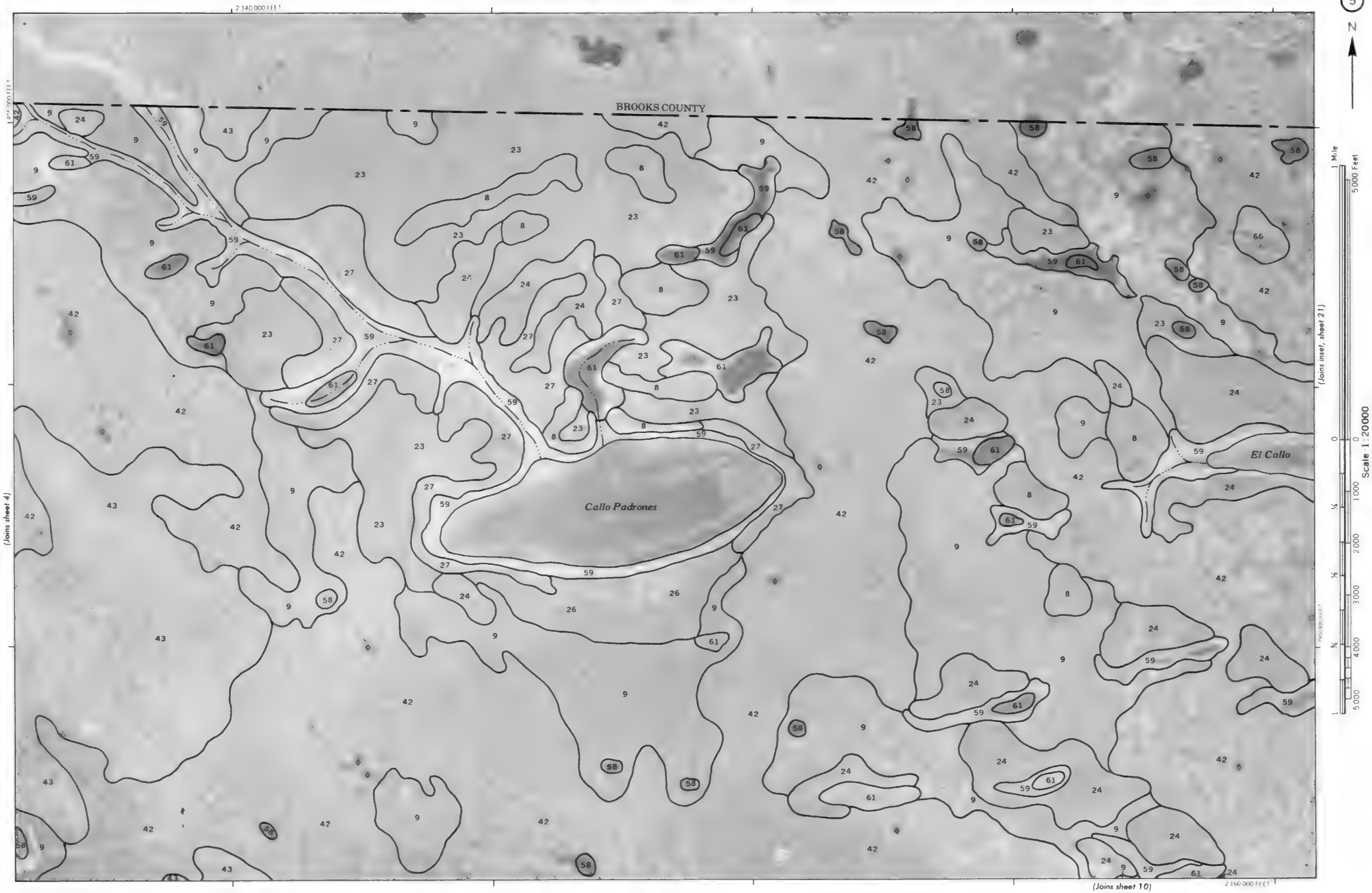

4
N
BROOKS COUNTY
SOUTHERN PACIFIC
281
Scale 1:20000
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
(Joins sheet 3)
(Joins sheet 5)
(Joins sheet 9)
2 115 000 FEET
2 135 000 FEET
395 000 FEET
42
43
58
59
66
9



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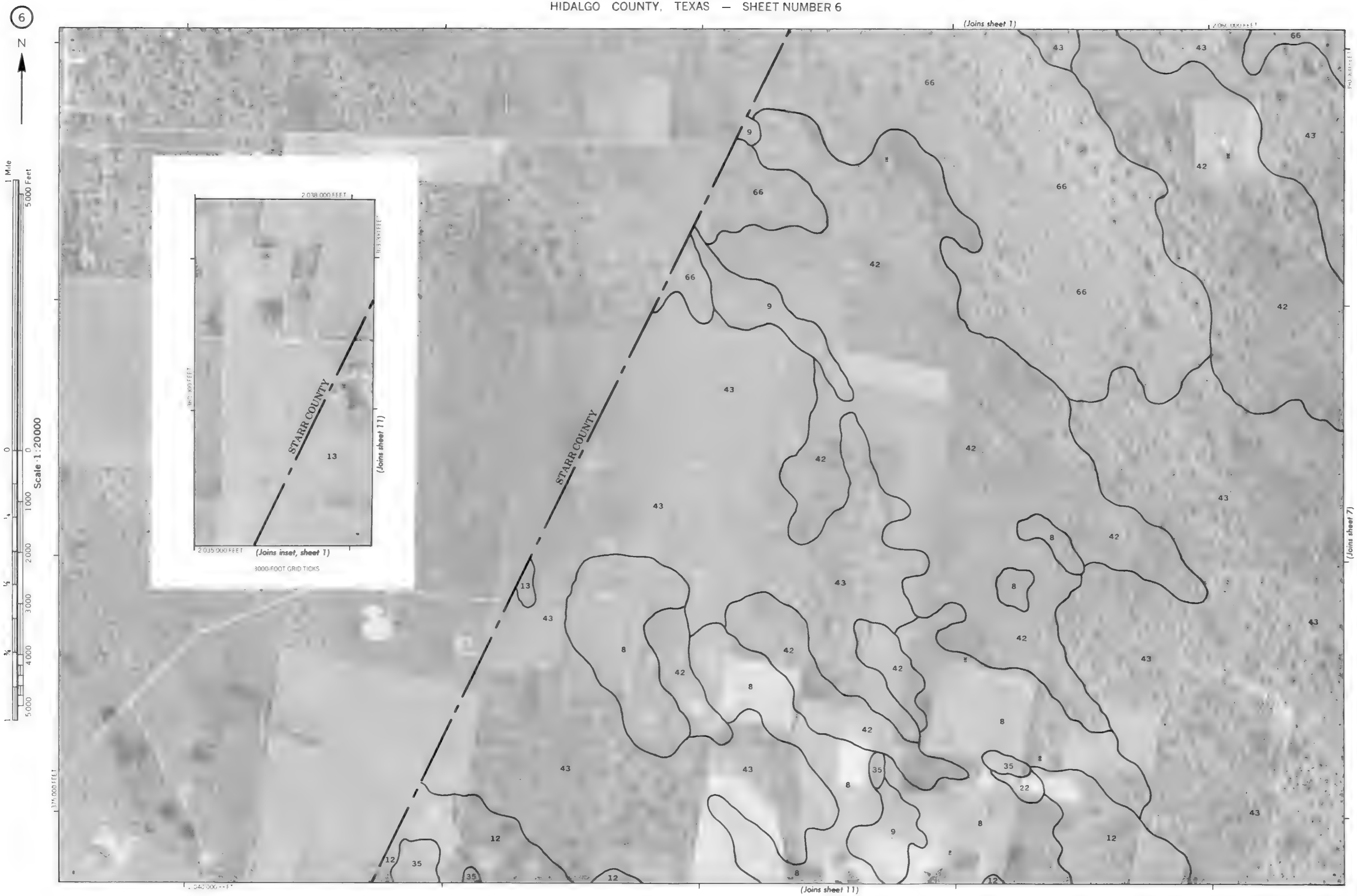
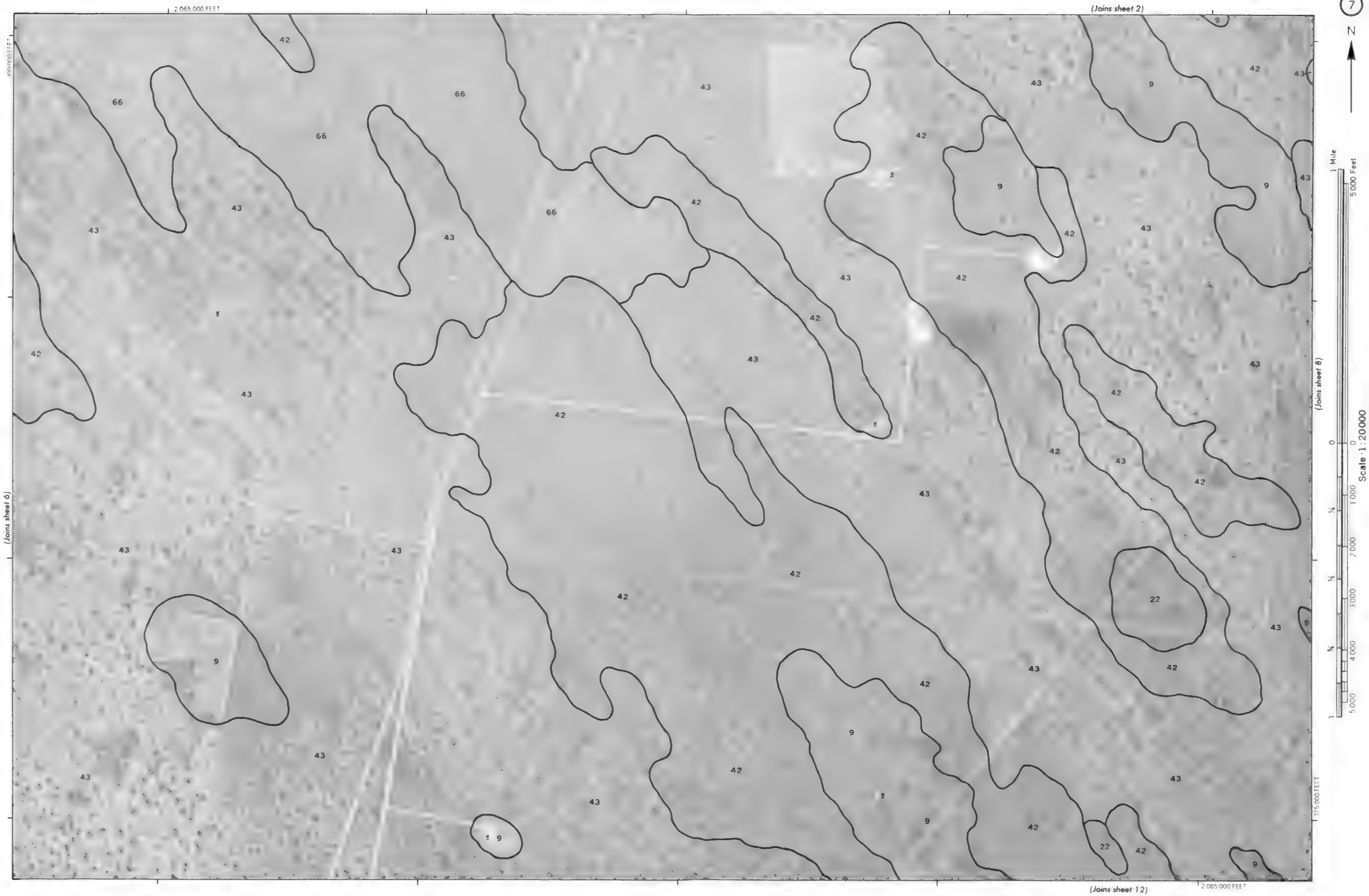

6
N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 1)
(Joins sheet 7)
(Joins sheet 11)
STARR COUNTY
2 038 000 FEET
2 035 000 FEET
(Joins inset, sheet 1)
(Joins sheet 11)
3000-FOOT GRID TICKS
STARR COUNTY
13



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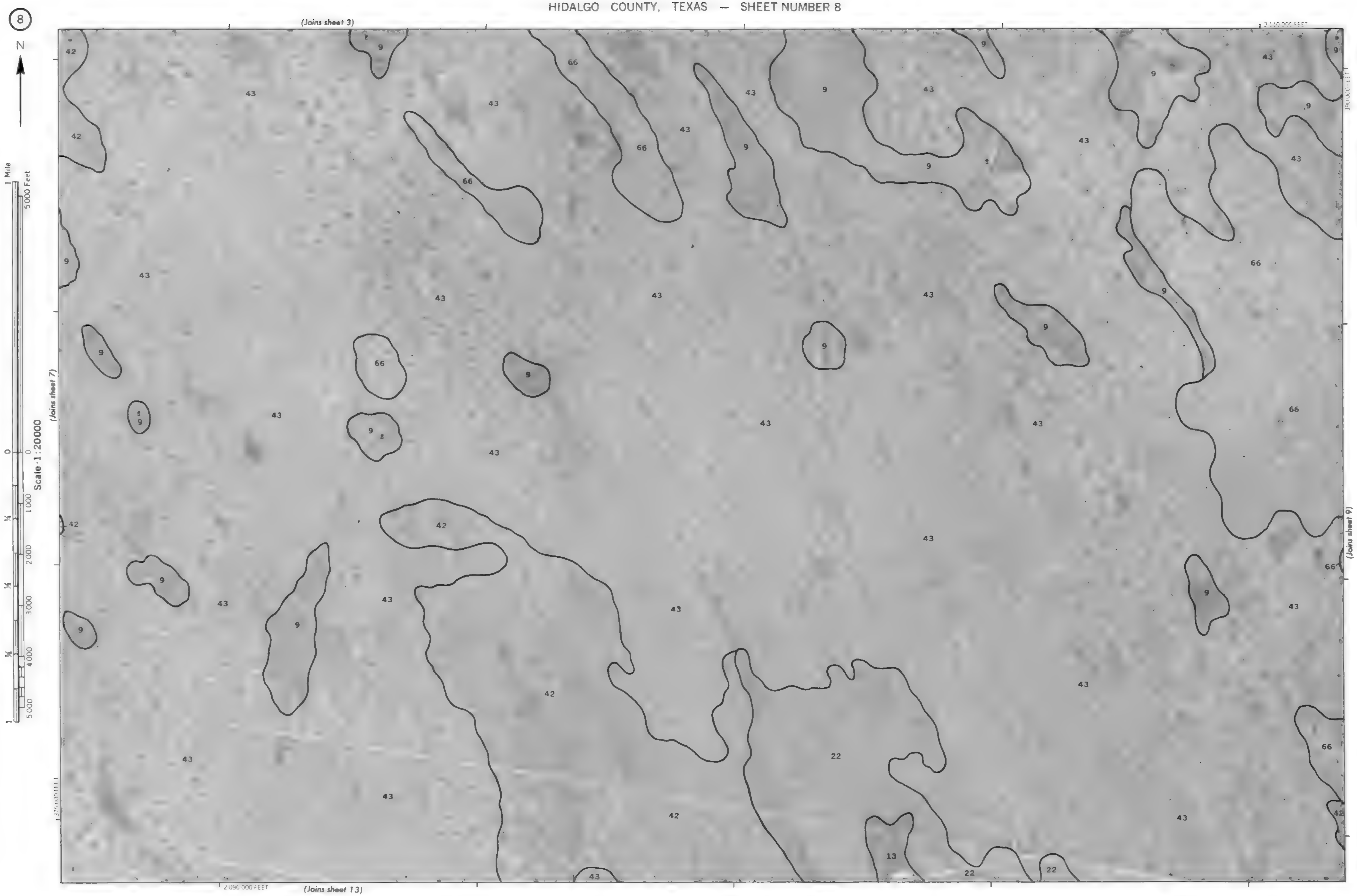
HIDALGO COUNTY, TEXAS — SHEET NUMBER 8



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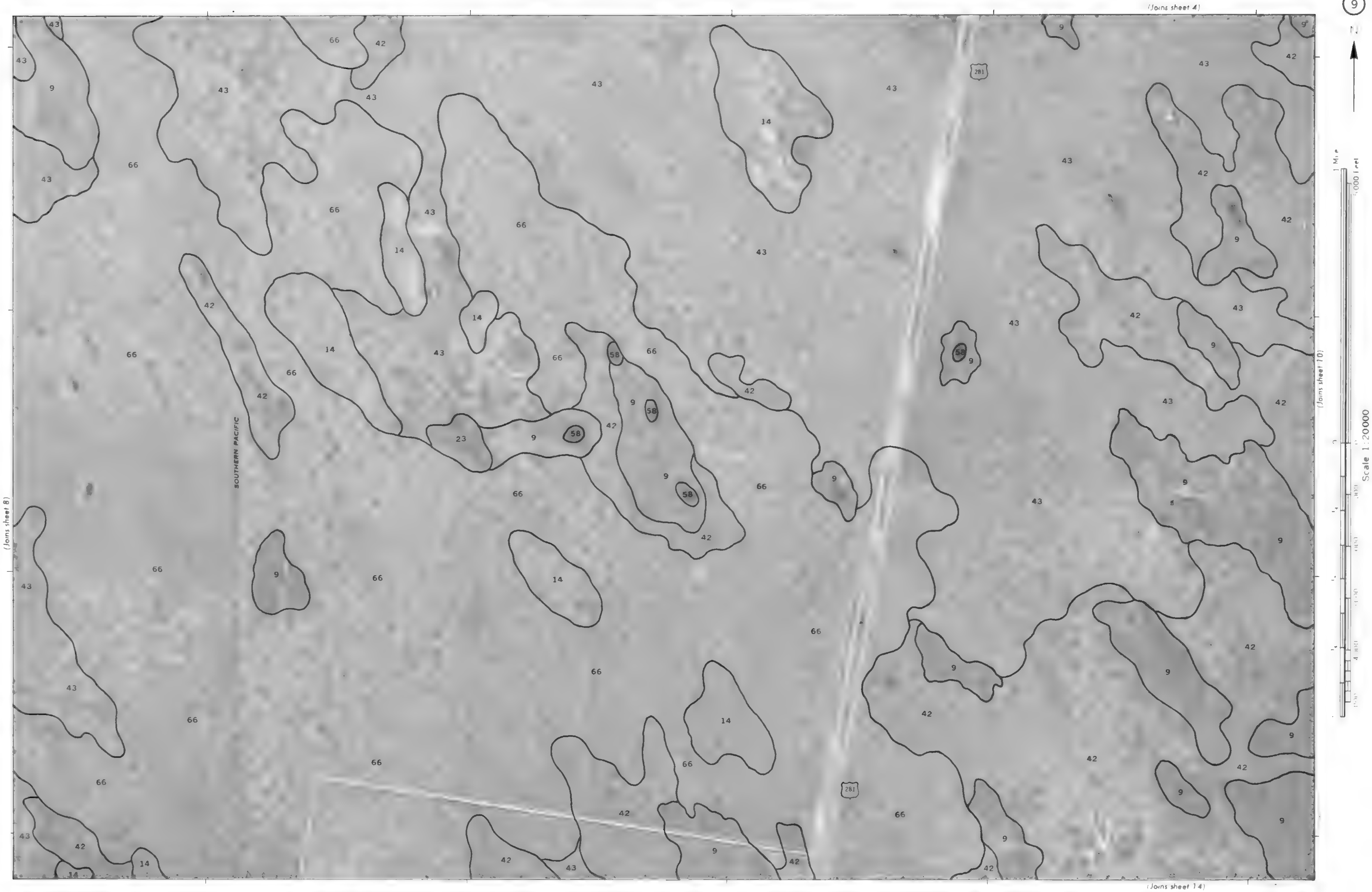
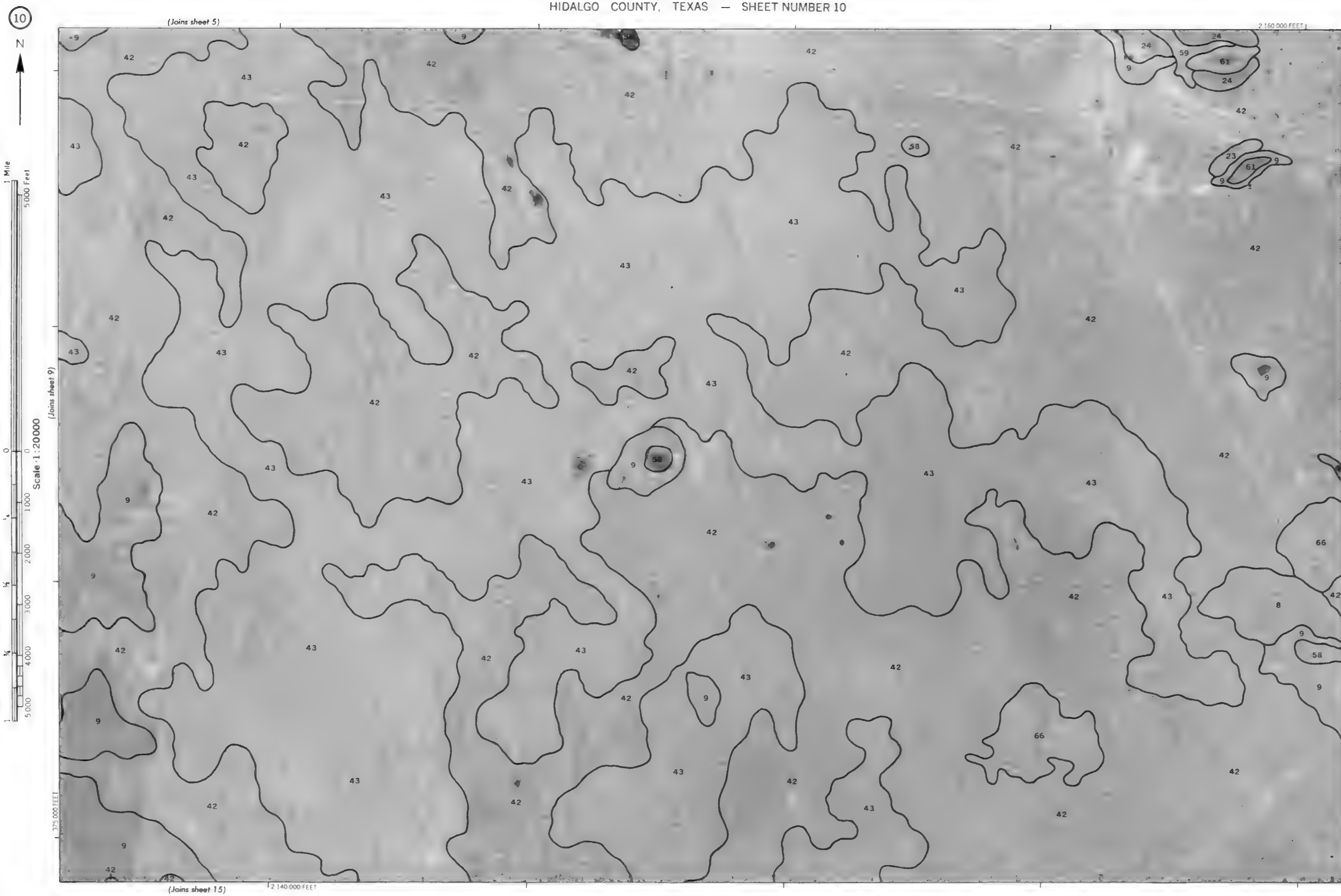
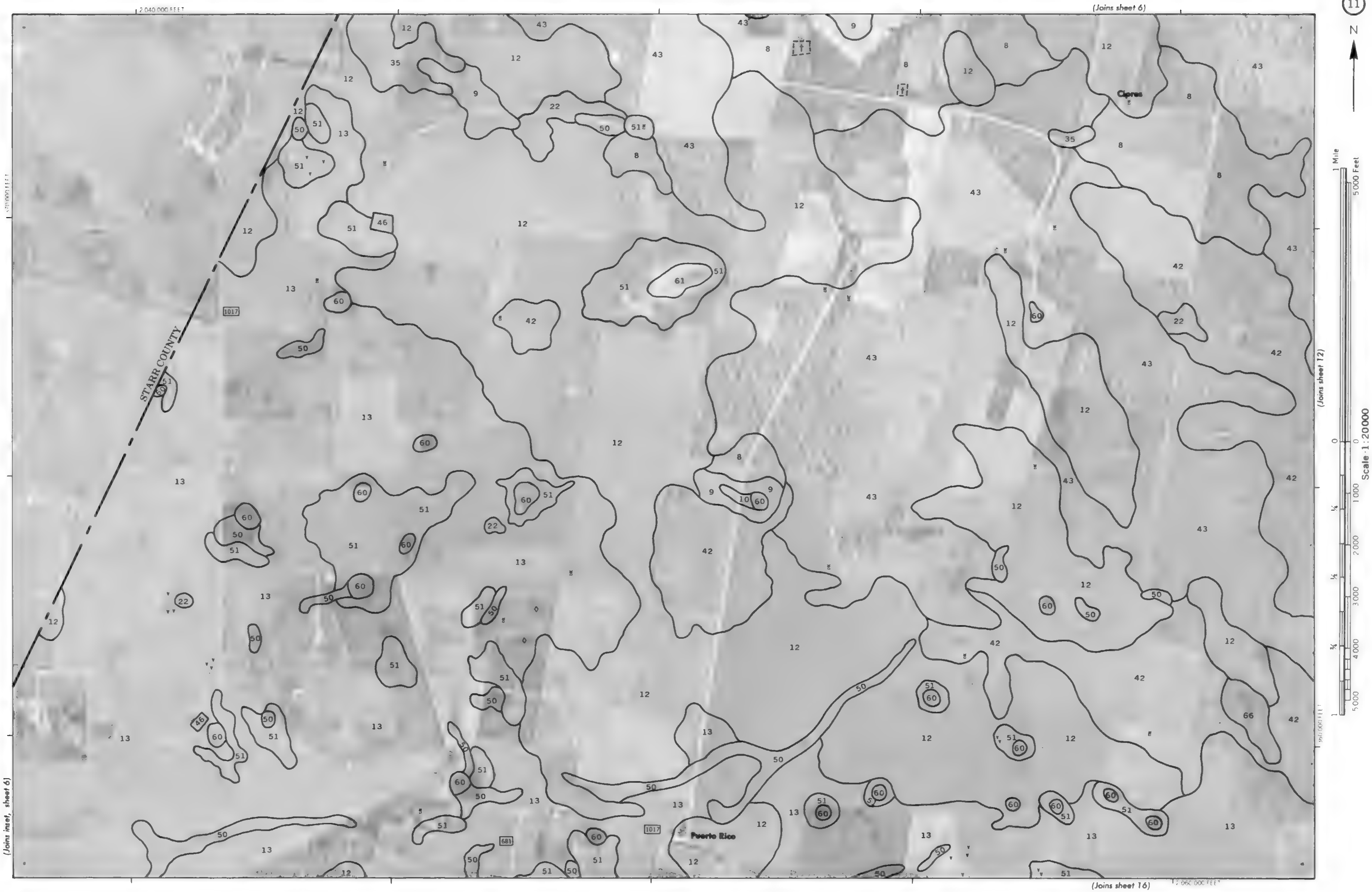
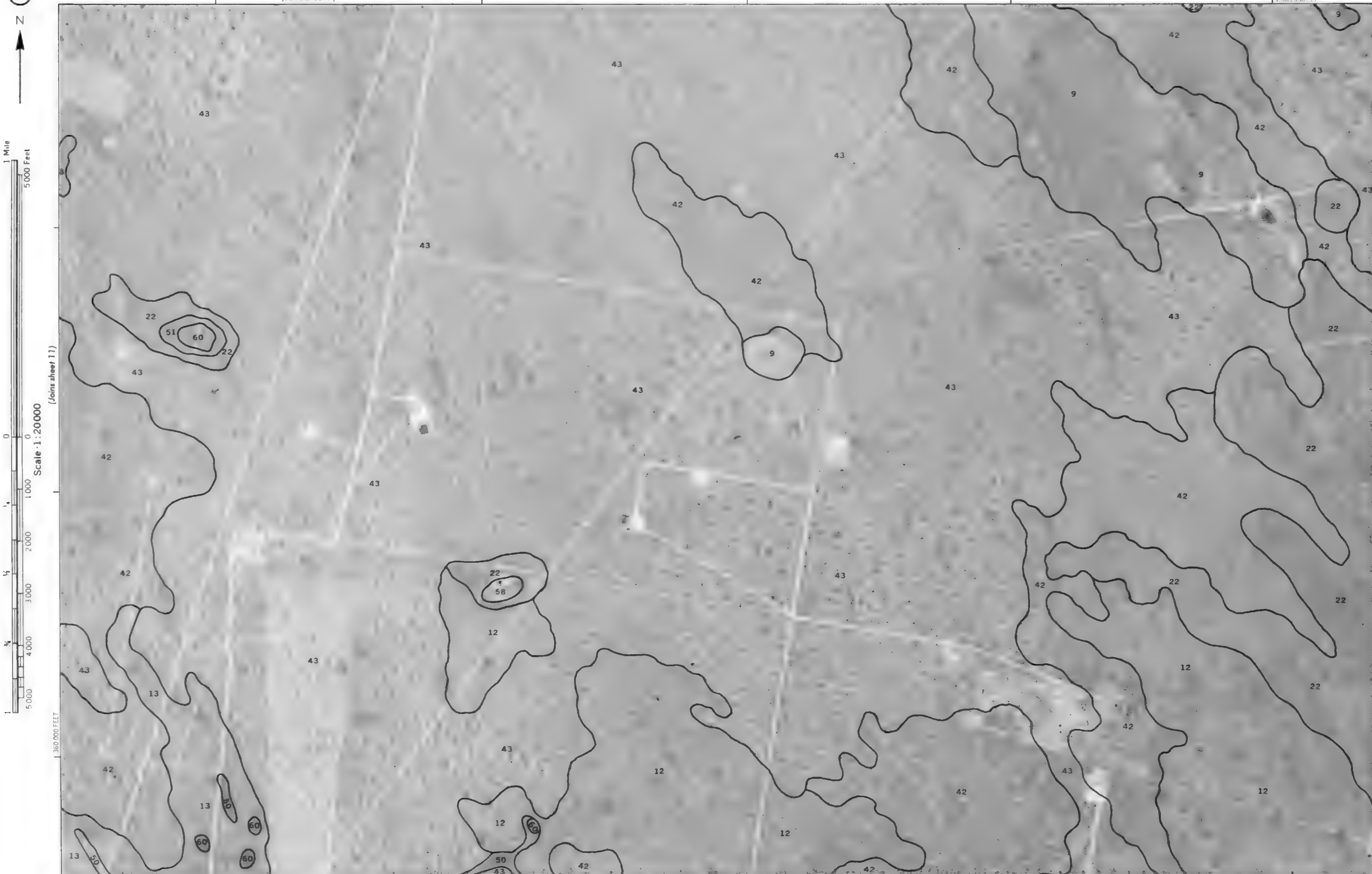

9
N
(Joins sheet 4)
(Joins sheet 8)
(Joins sheet 10)
(Joins sheet 14)
SOUTHERN PACIFIC
281
Scale 1:20000
1 Mile
5000 Feet
9
14
23
42
43
58
66


10
N
(Joins sheet 5)
(Joins sheet 9)
(Joins inset, sheet 28)
(Joins sheet 15)
2 160 000 FEET
2 140 000 FEET
375 000 FEET
Scale 1:20000
1 Mile
5000 Feet


11
N
(Joins sheet 6)
STARR COUNTY
Cipres
Puerto Rico
1017
681
(Joins sheet 12)
(Joins sheet 16)
(Joins inset, sheet 6)
1 Mile
5000 Feet
Scale 1:20000

(Joins sheet 7)



(Joins sheet 11)

(Joins sheet 13)

(Joins sheet 17)

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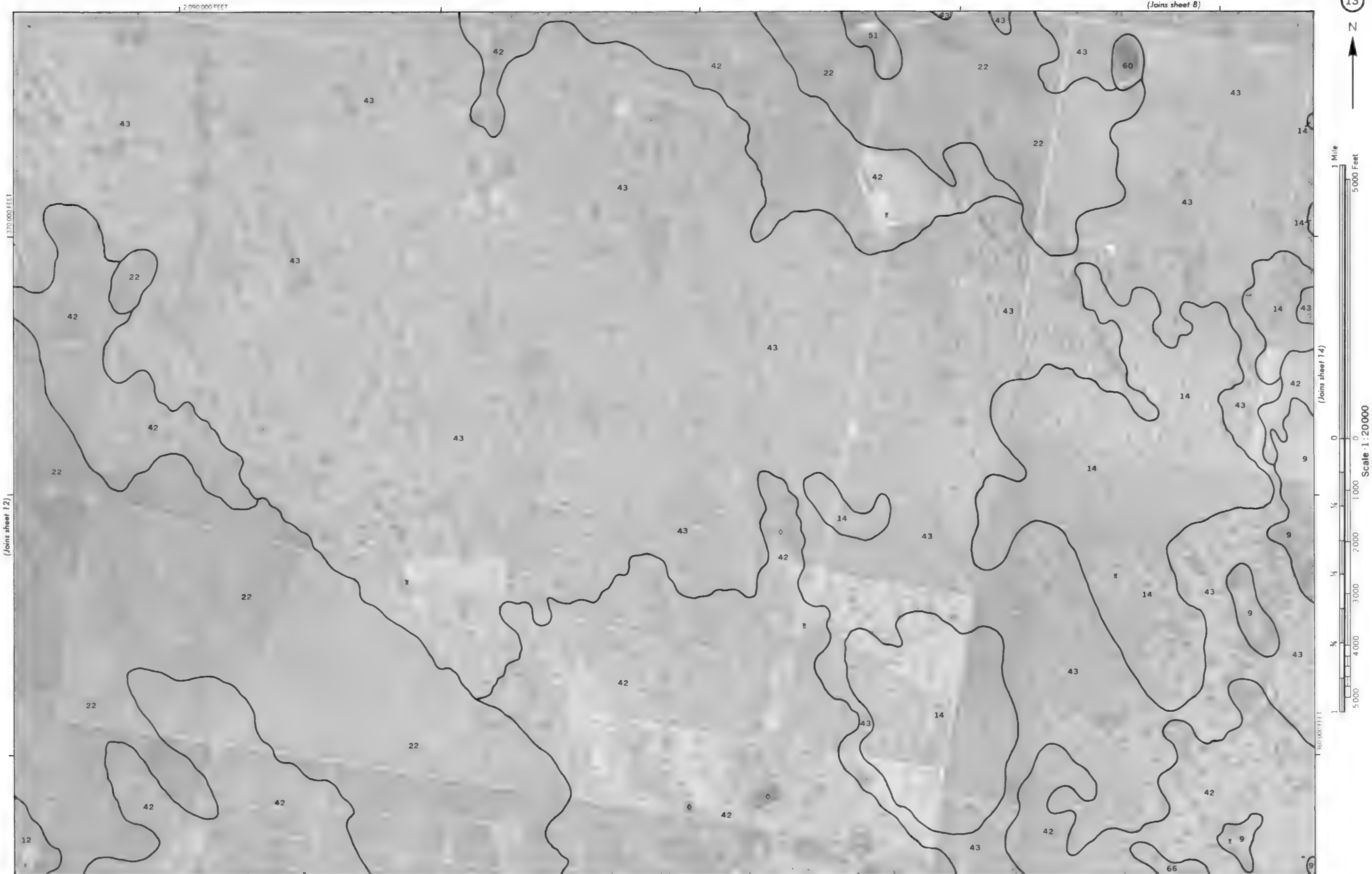
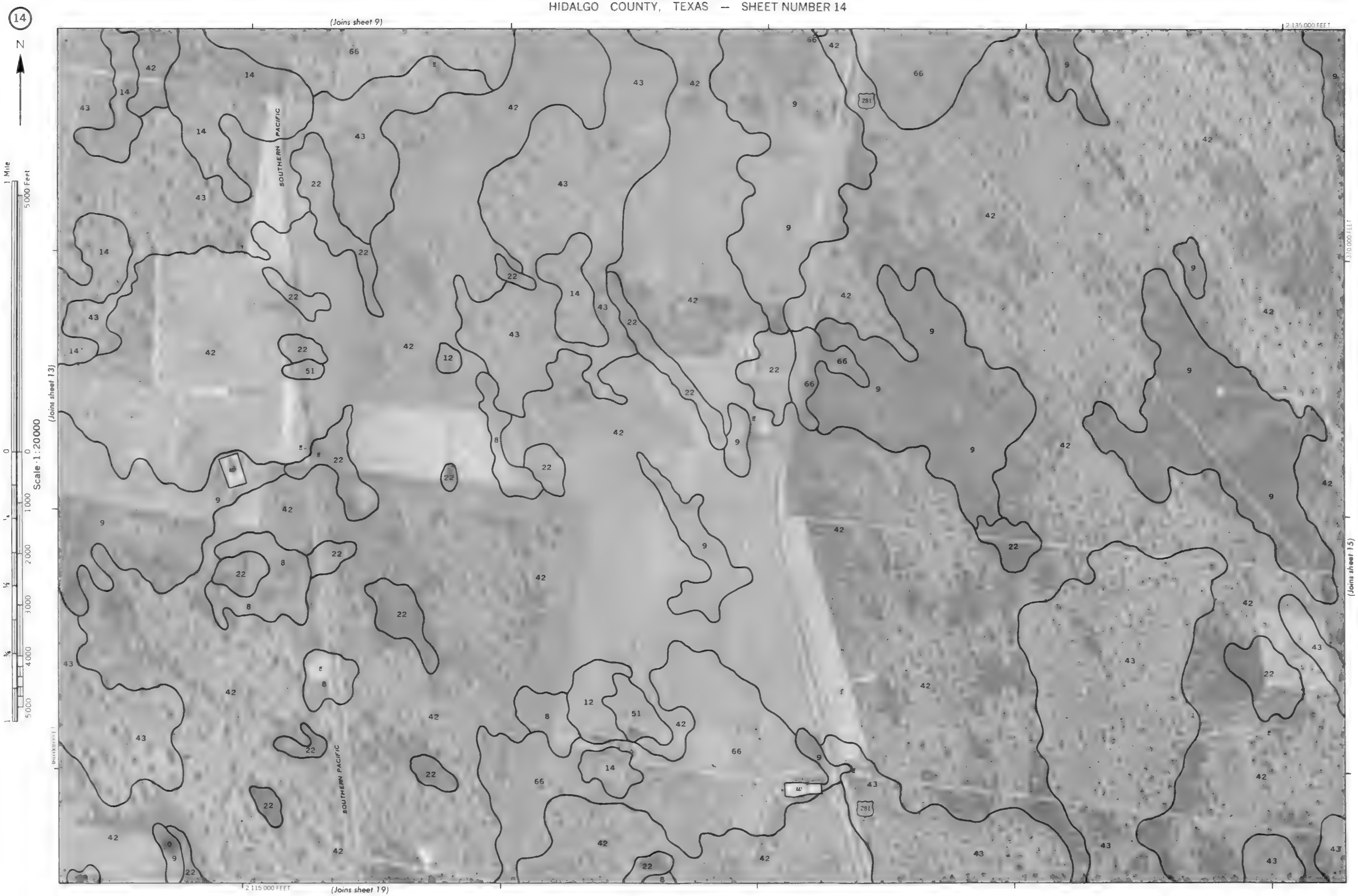
13



2 090 000 FEET
(Joins sheet 8)
N
370 000 FEET
(Joins sheet 12)
(Joins sheet 14)
(Joins sheet 18)
360 000 FEET
2 110 000 FEET
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
42
43
22
51
60
14
9
12
66



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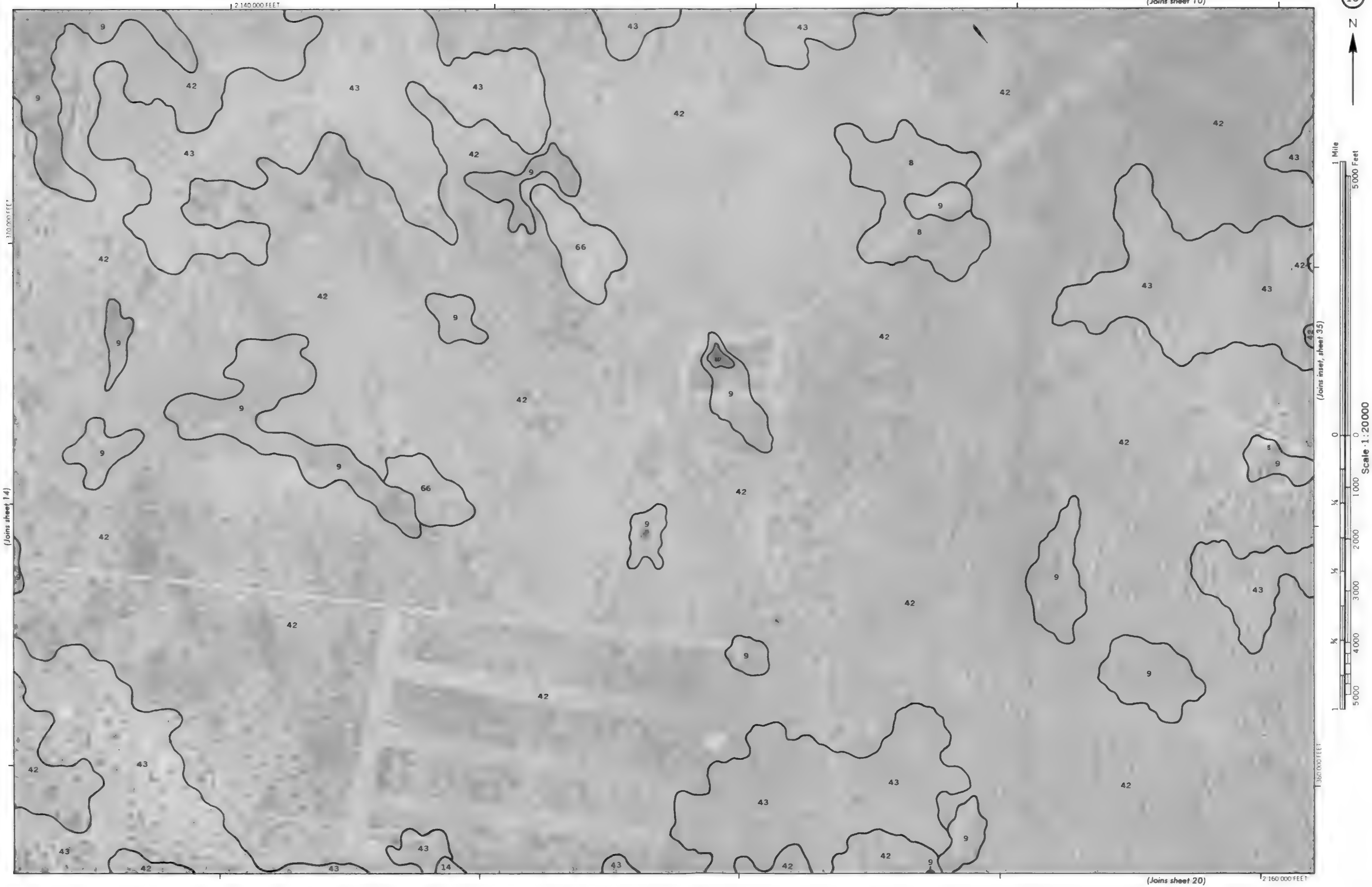

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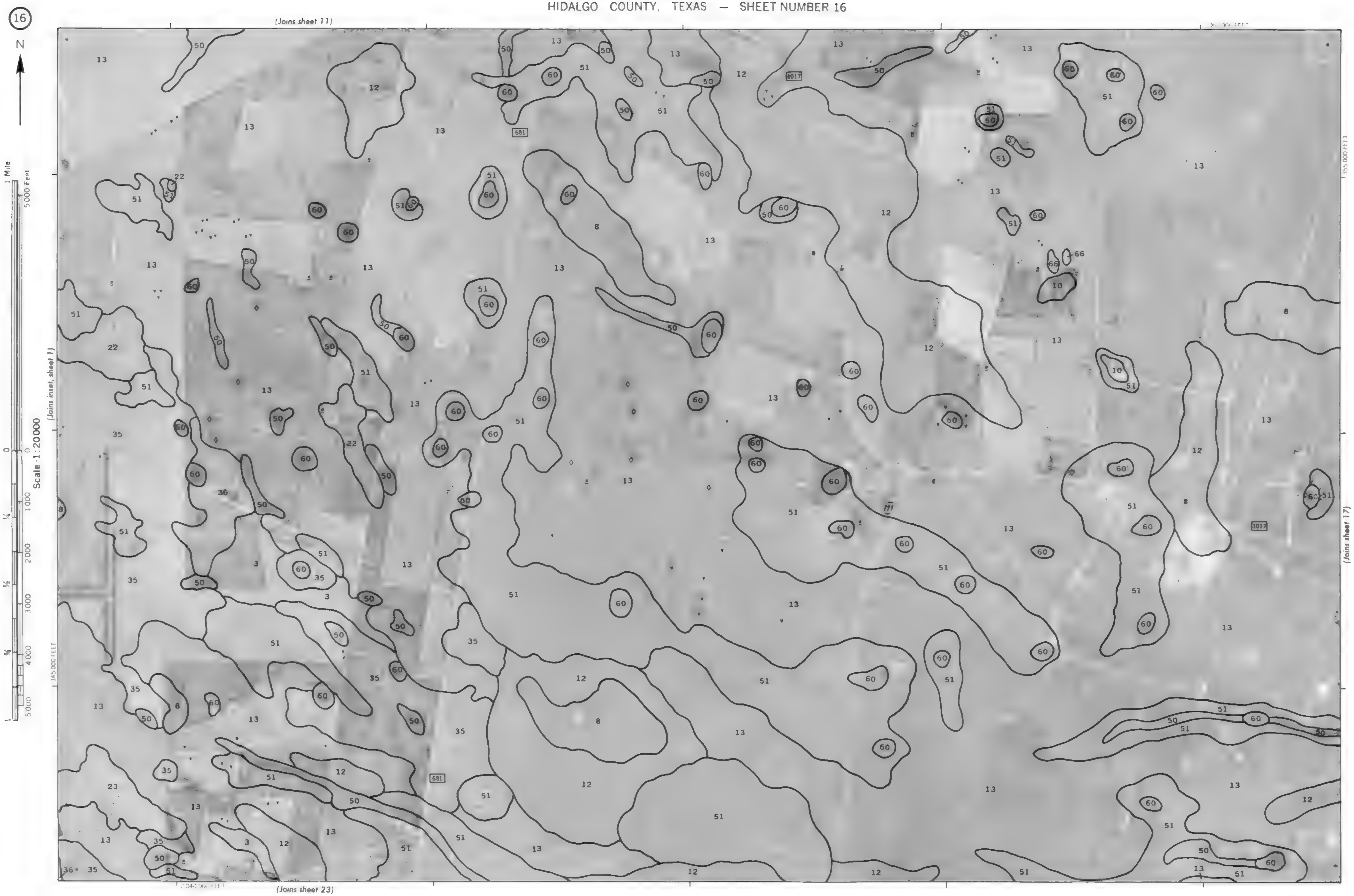

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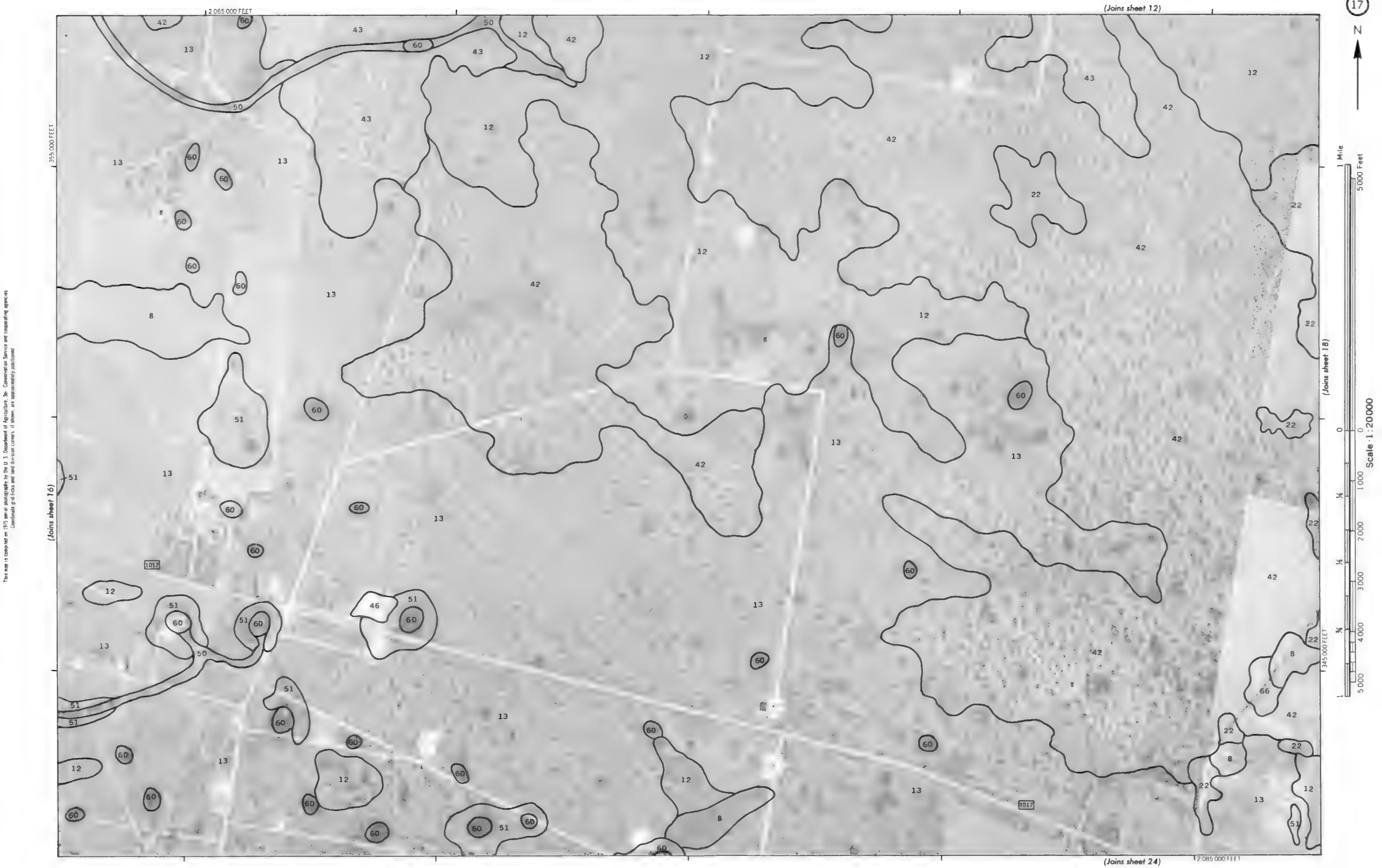
17
N
(Joins sheet 12)
(Joins sheet 16)
(Joins sheet 18)
(Joins sheet 24)
2 065 000 FEET
2 085 000 FEET
355 000 FEET
345 000 FEET
1017
1 Mile
5000 Feet
Scale 1:20000
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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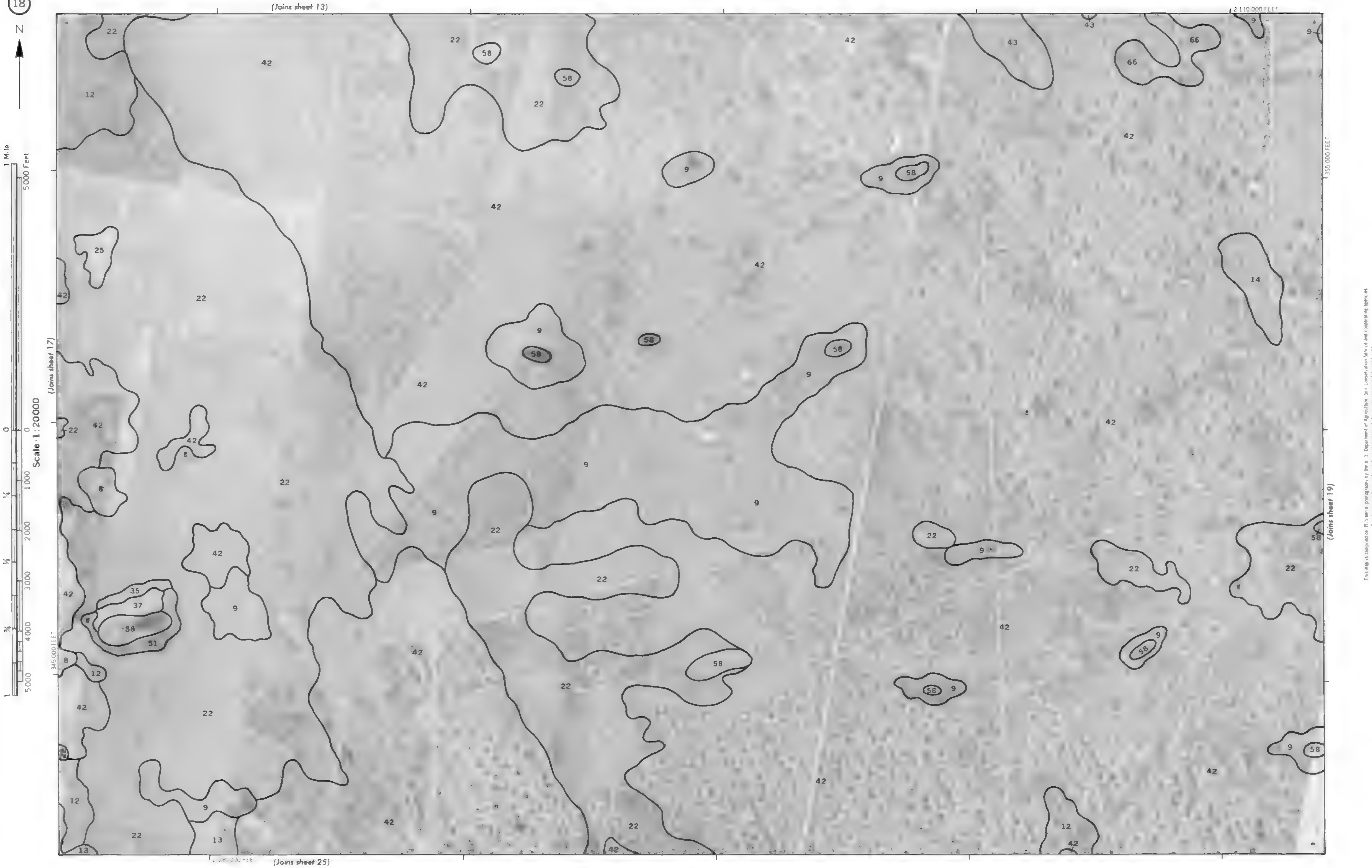
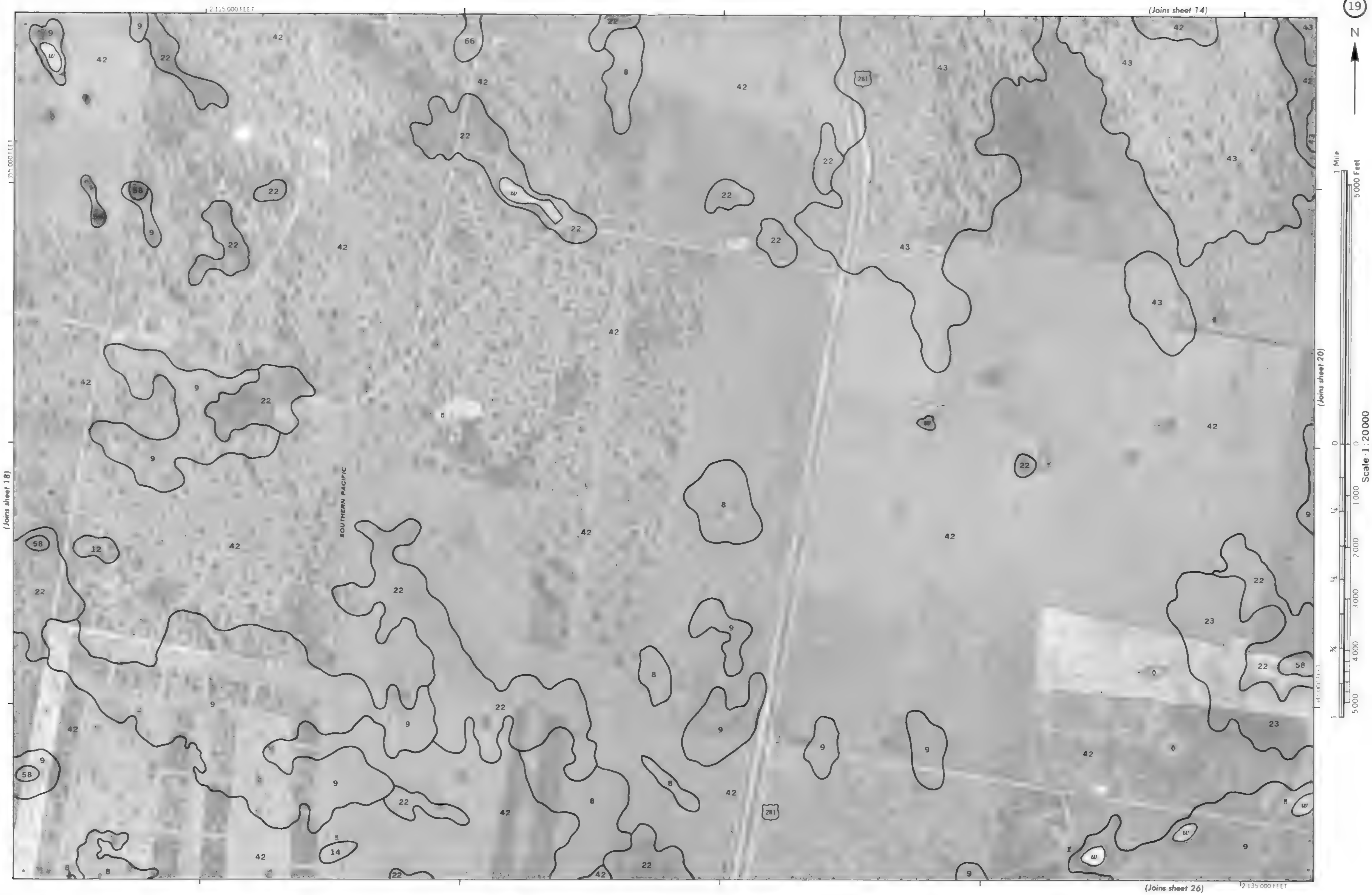
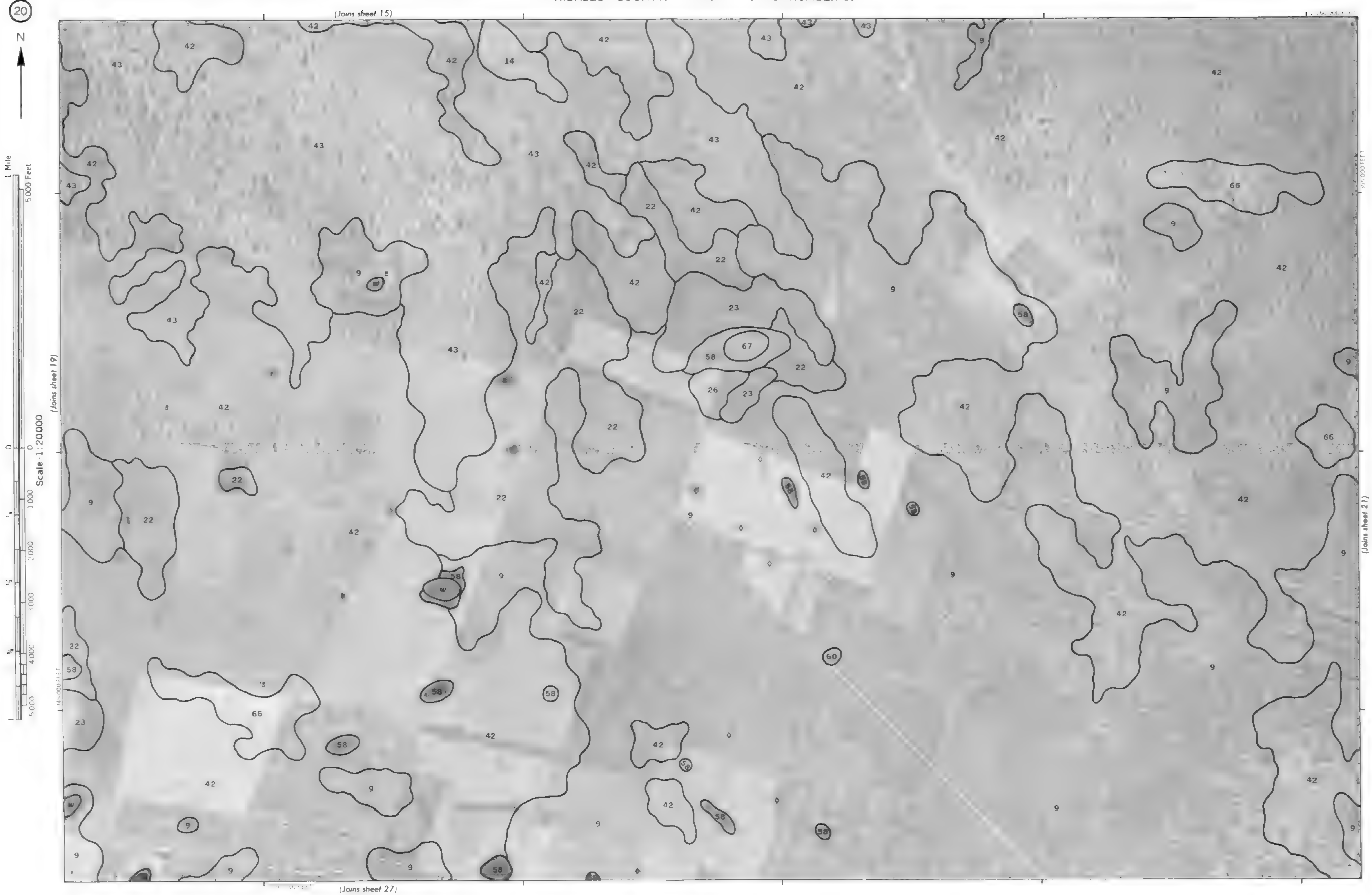

18
N
(Joins sheet 13)
(Joins sheet 17)
(Joins sheet 19)
(Joins sheet 25)
Scale 1:20000
1 Mile
5000 Feet
2 110 000 FEET
355 000 FEET
345 000 FEET


19
N
(Joins sheet 14)
(Joins sheet 18)
(Joins sheet 20)
(Joins sheet 26)
2 115 000 FEET
2 135 000 FEET
SOUTHERN PACIFIC
281
1 Mile
5000 Feet
Scale 1:20000


20
N
(Joins sheet 15)
(Joins sheet 19)
(Joins sheet 21)
(Joins sheet 27)
Scale 1:20000
1 Mile
5000 Feet

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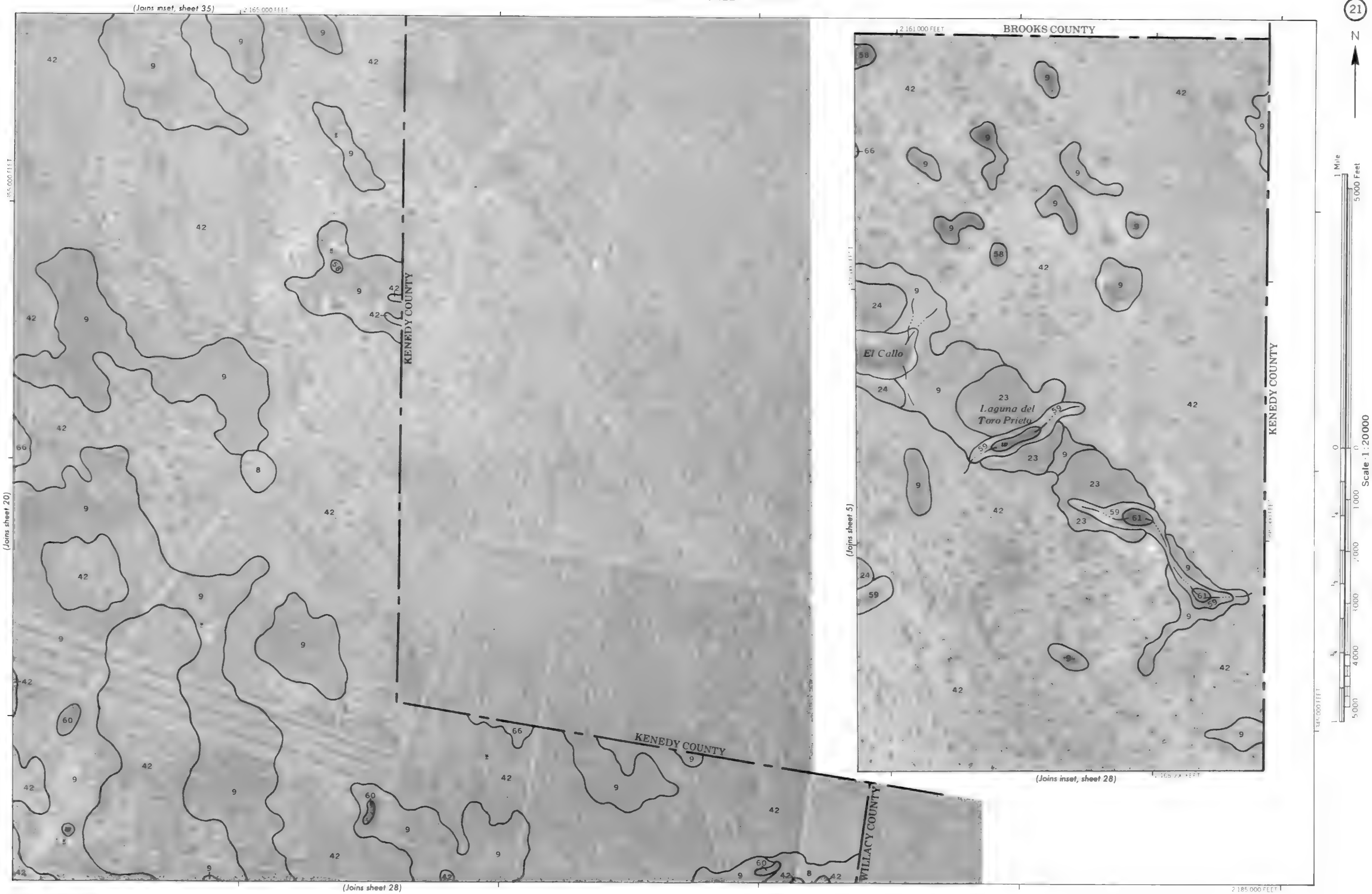
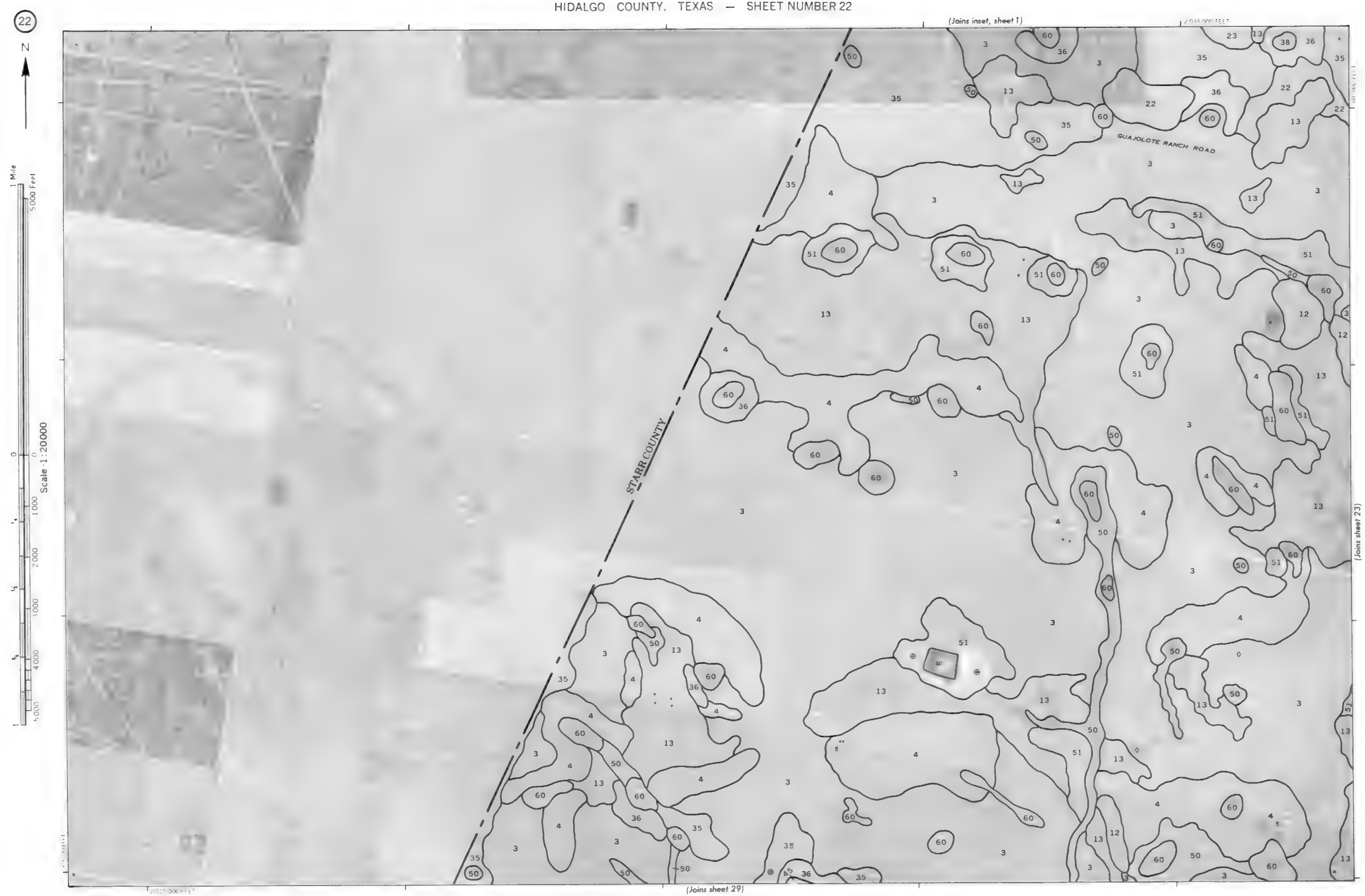
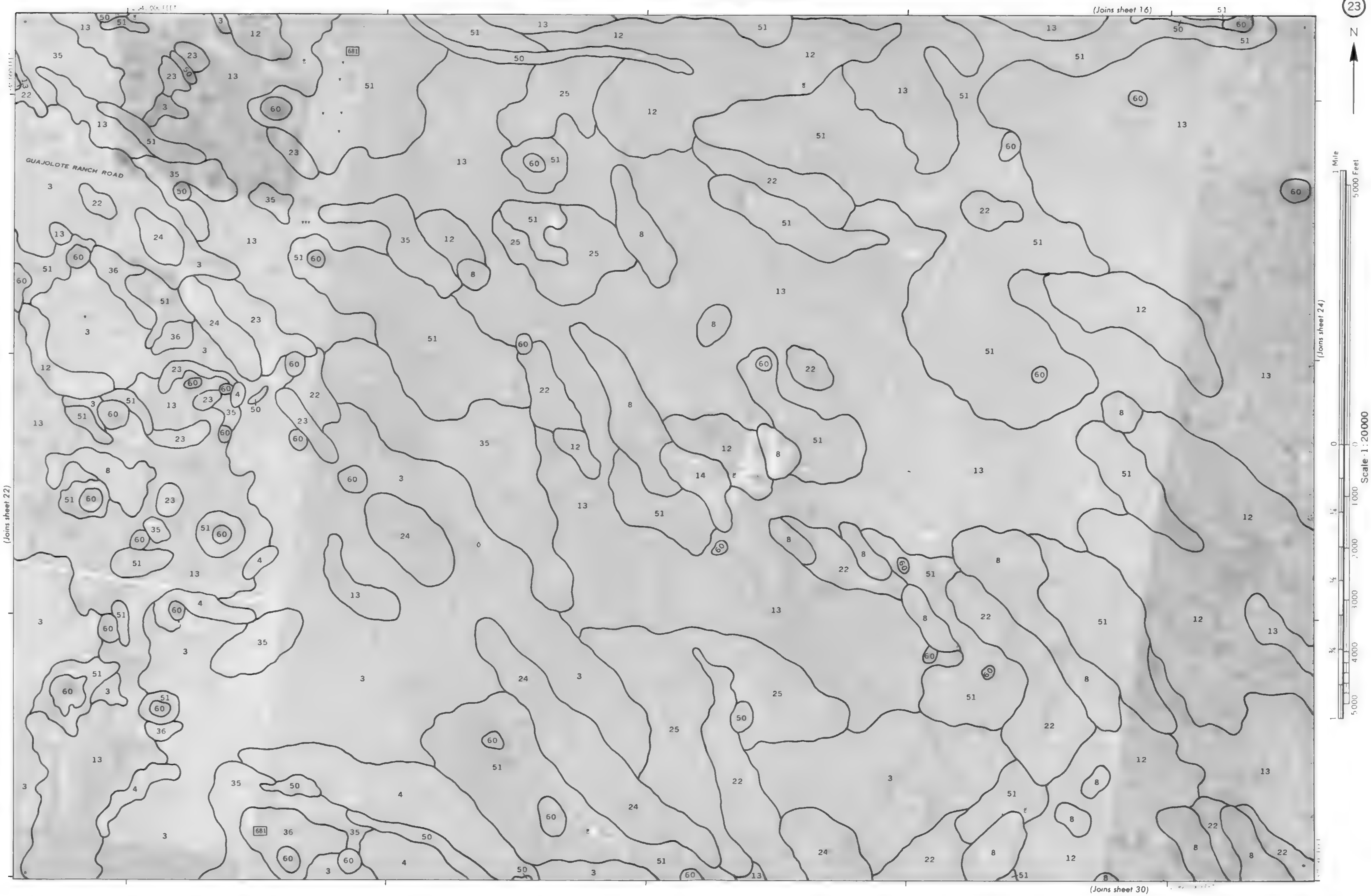
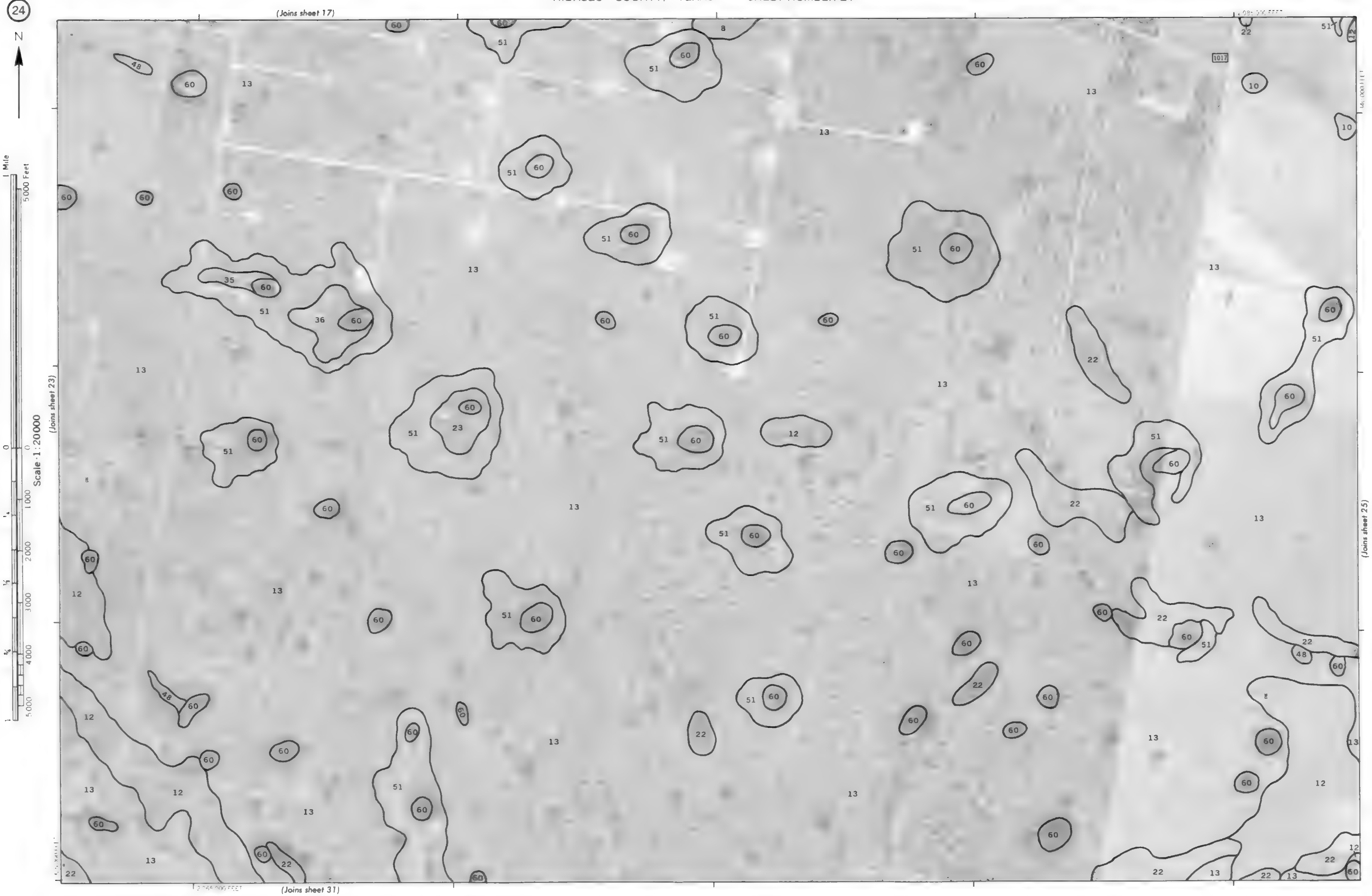



22
N
1 Mile
5000 Feet
Scale 1:20000
(Joins inset, sheet 1)
(Joins sheet 23)
(Joins sheet 29)
GUAJOLOTE RANCH ROAD
STARR COUNTY


23
(Joins sheet 16)
(Joins sheet 22)
(Joins sheet 24)
(Joins sheet 30)
GUAJOLOTE RANCH ROAD
681
N
1 Mile
5000 Feet
Scale 1:20000



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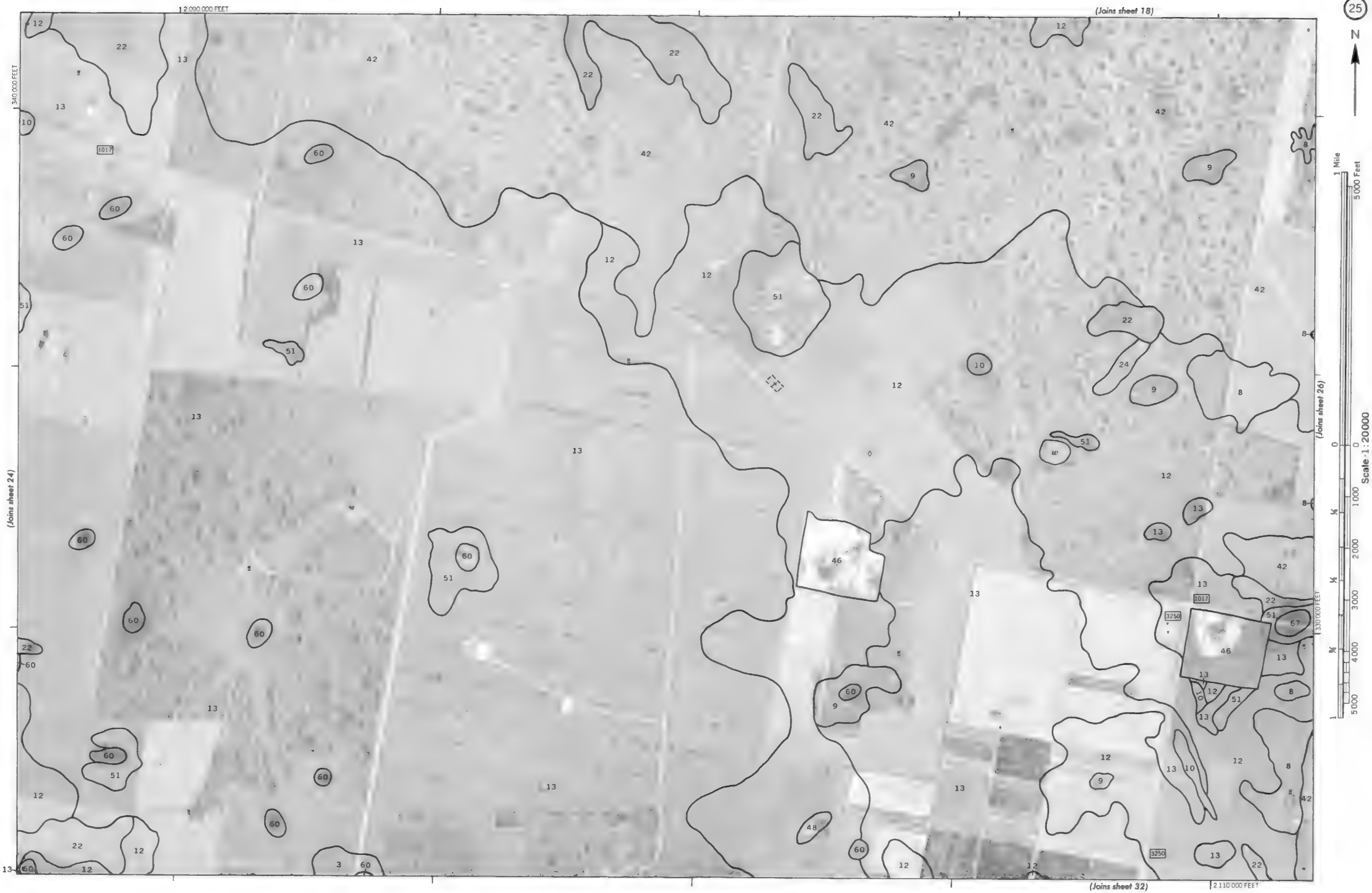
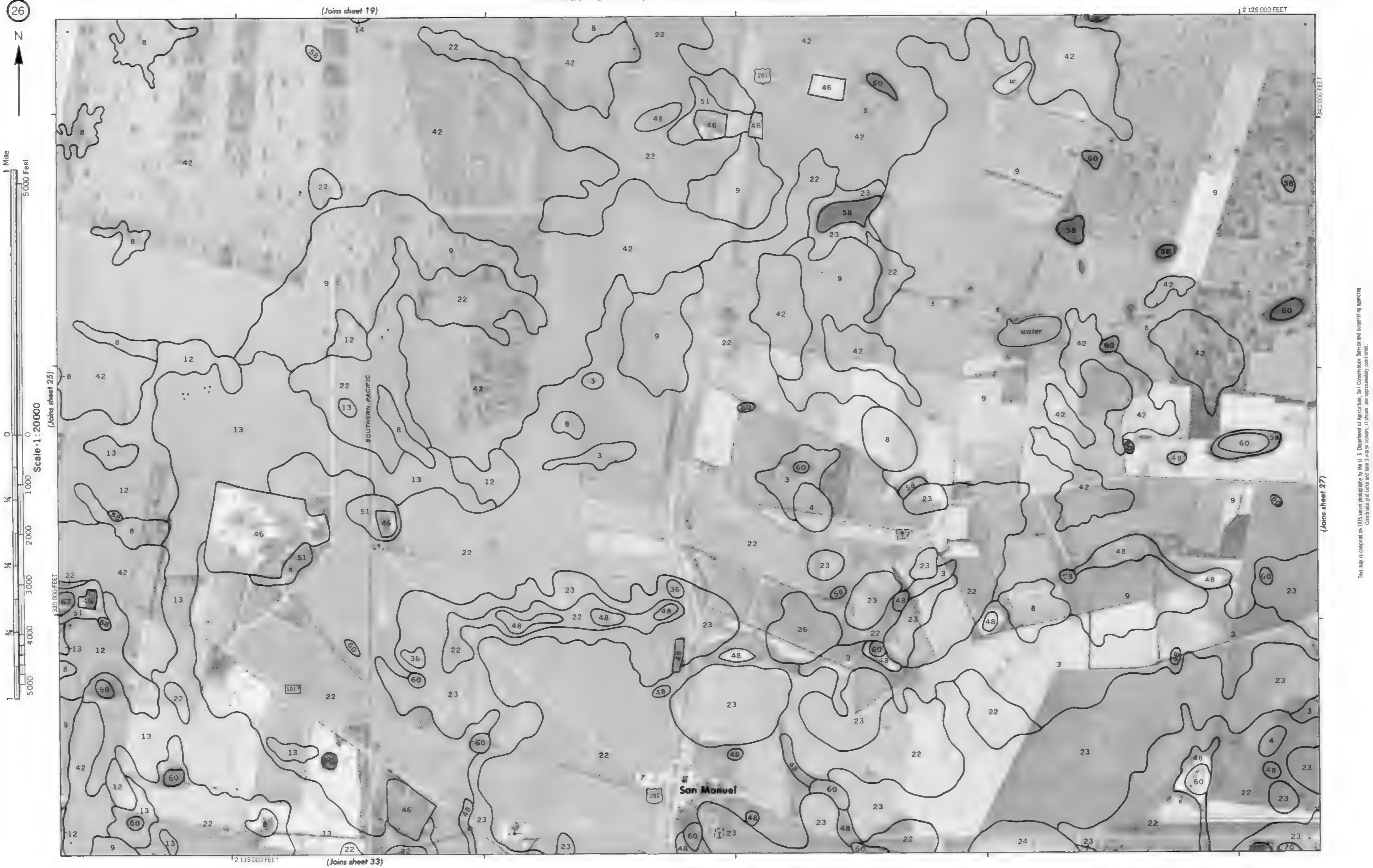
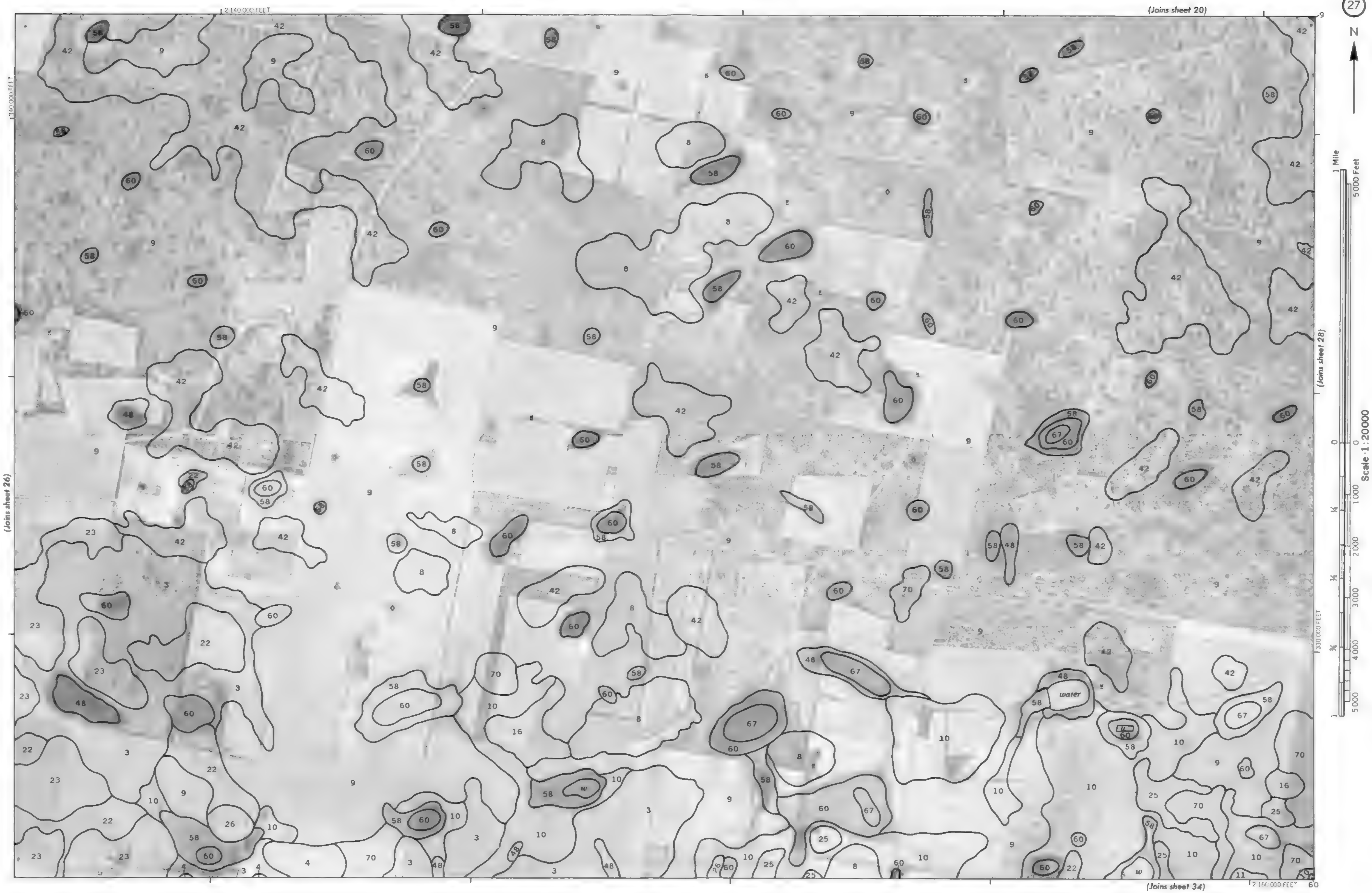

25
N
(Joins sheet 18)
(Joins sheet 24)
(Joins sheet 26)
(Joins sheet 32)
2 090 000 FEET
340 000 FEET
330 000 FEET
2 110 000 FEET
1017
3250
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000


26
N
(Joins sheet 19)
(Joins sheet 33)
(Joins sheet 25)
(Joins sheet 27)
2 125 000 FEET
2 115 000 FEET
340 000 FEET
330 000 FEET
Scale 1:20000
1 Mile
5000 Feet
SOUTHERN PACIFIC
San Manuel
281
1017
water
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



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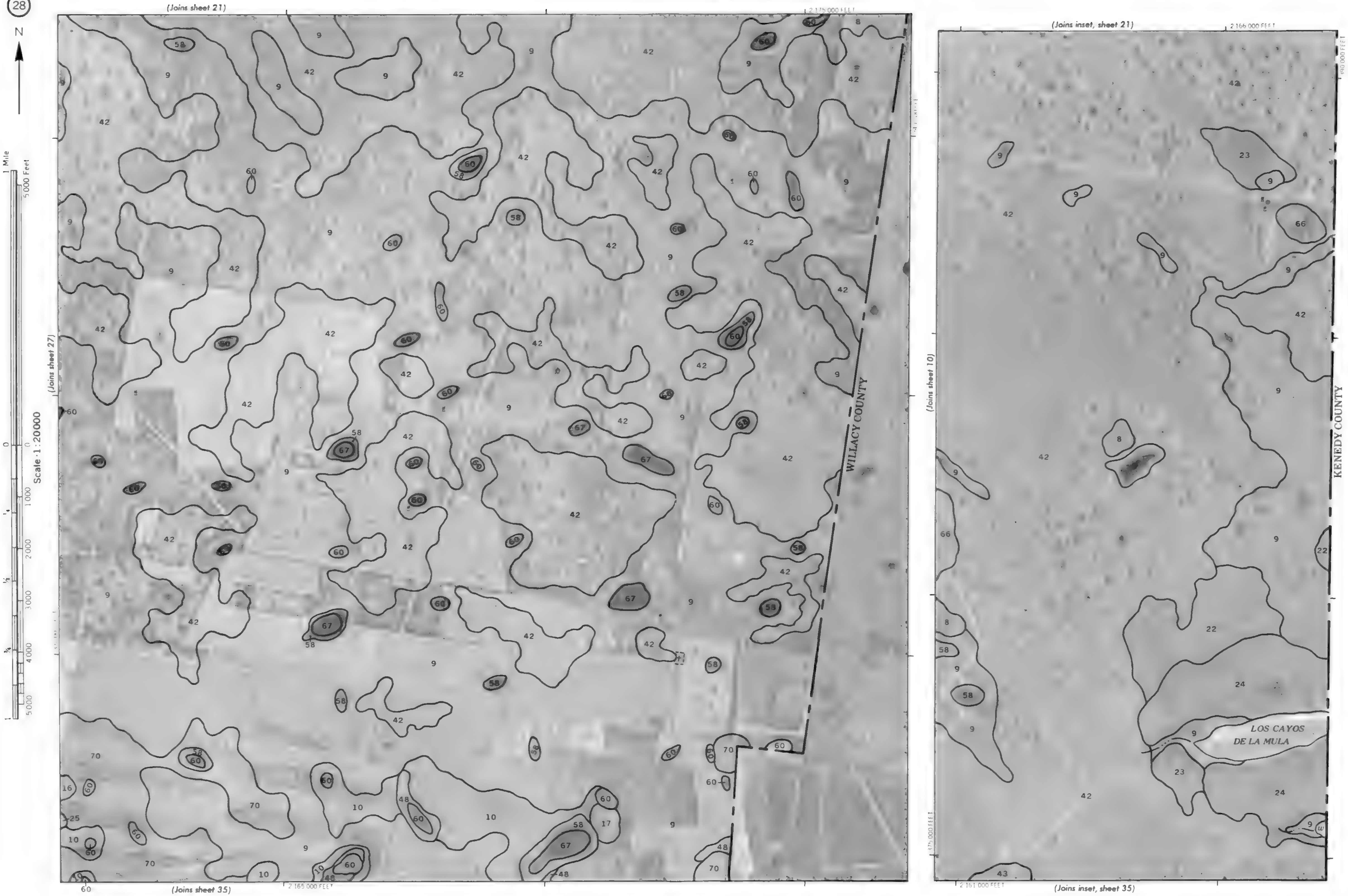
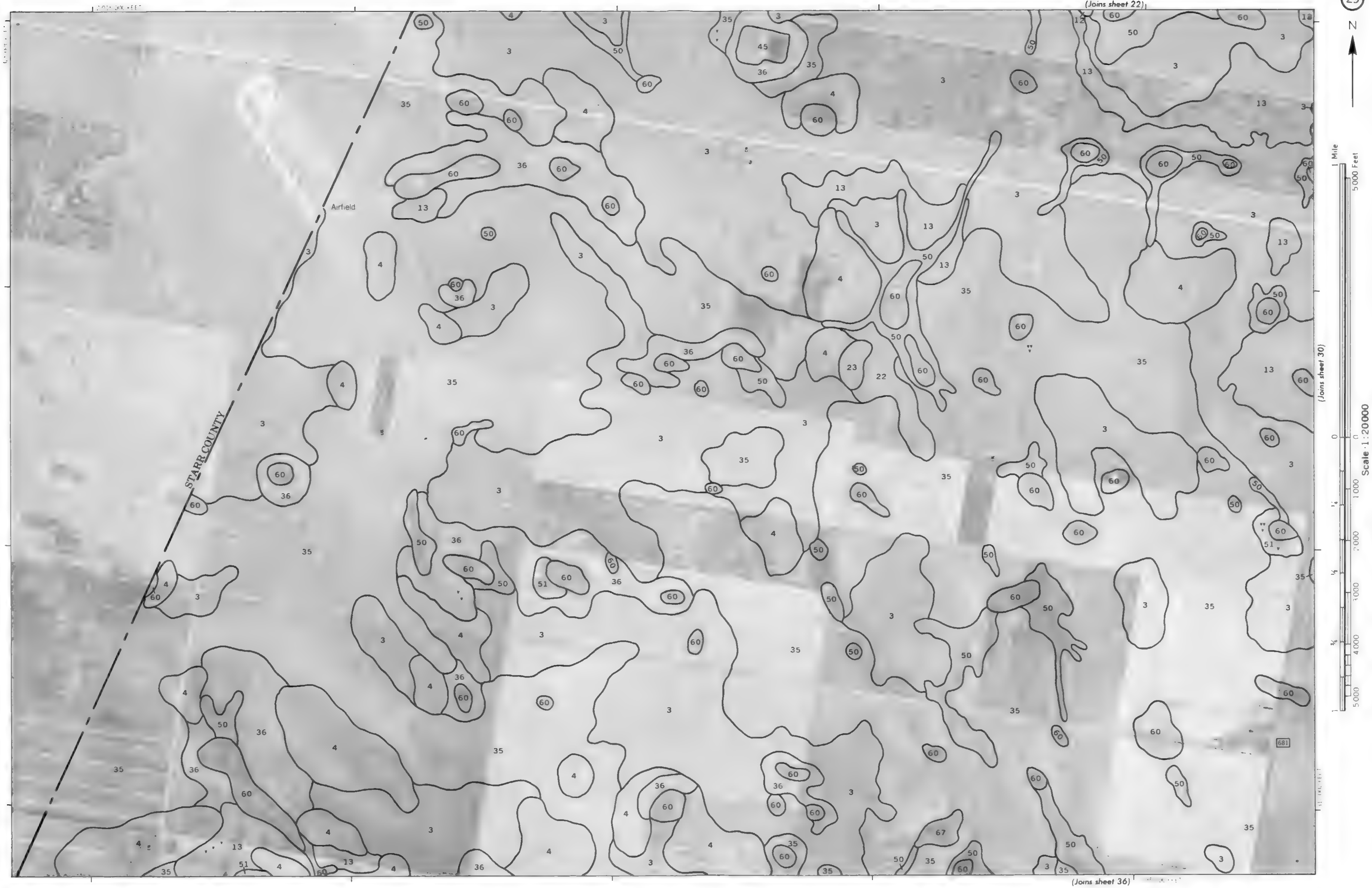
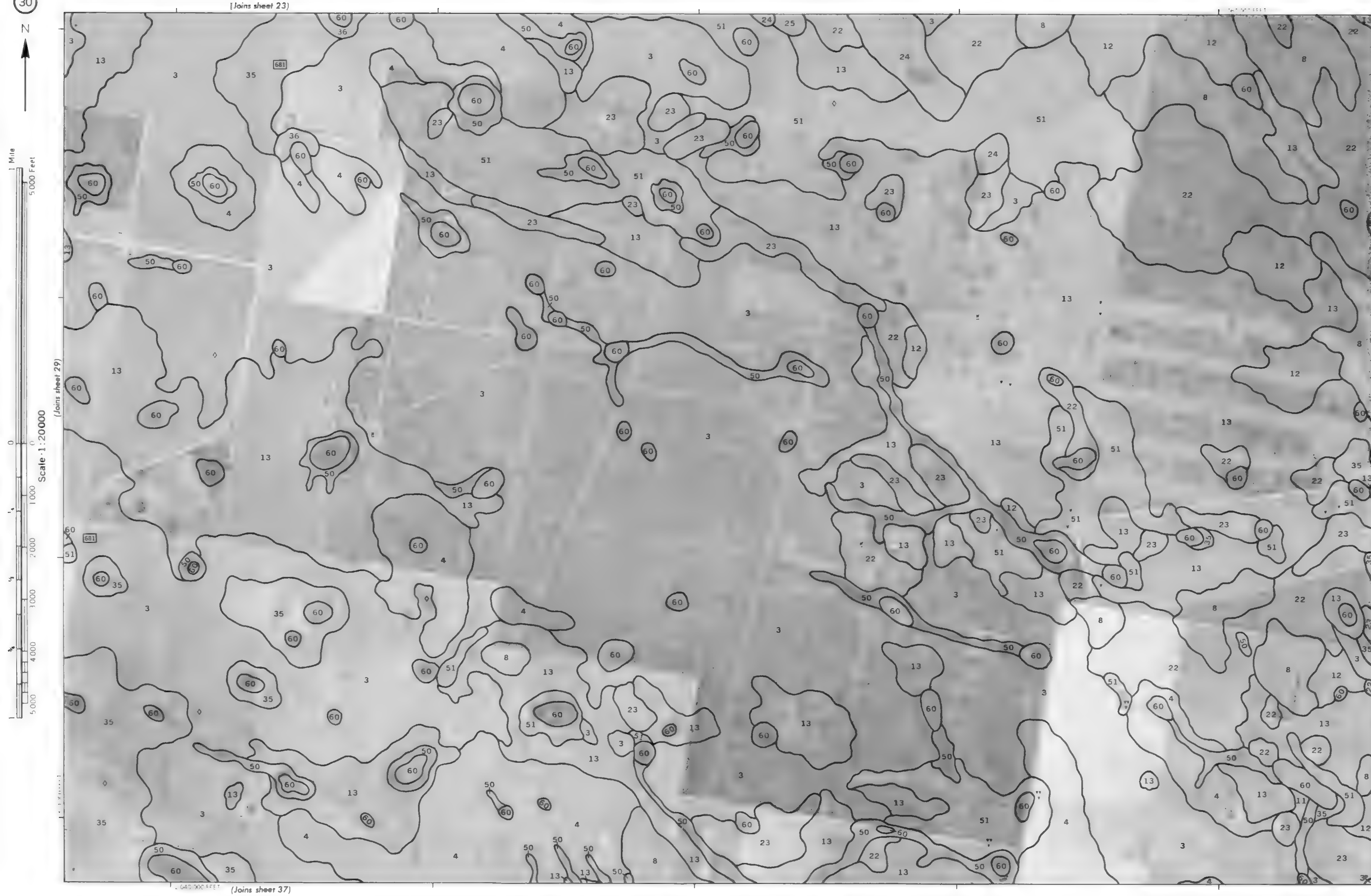
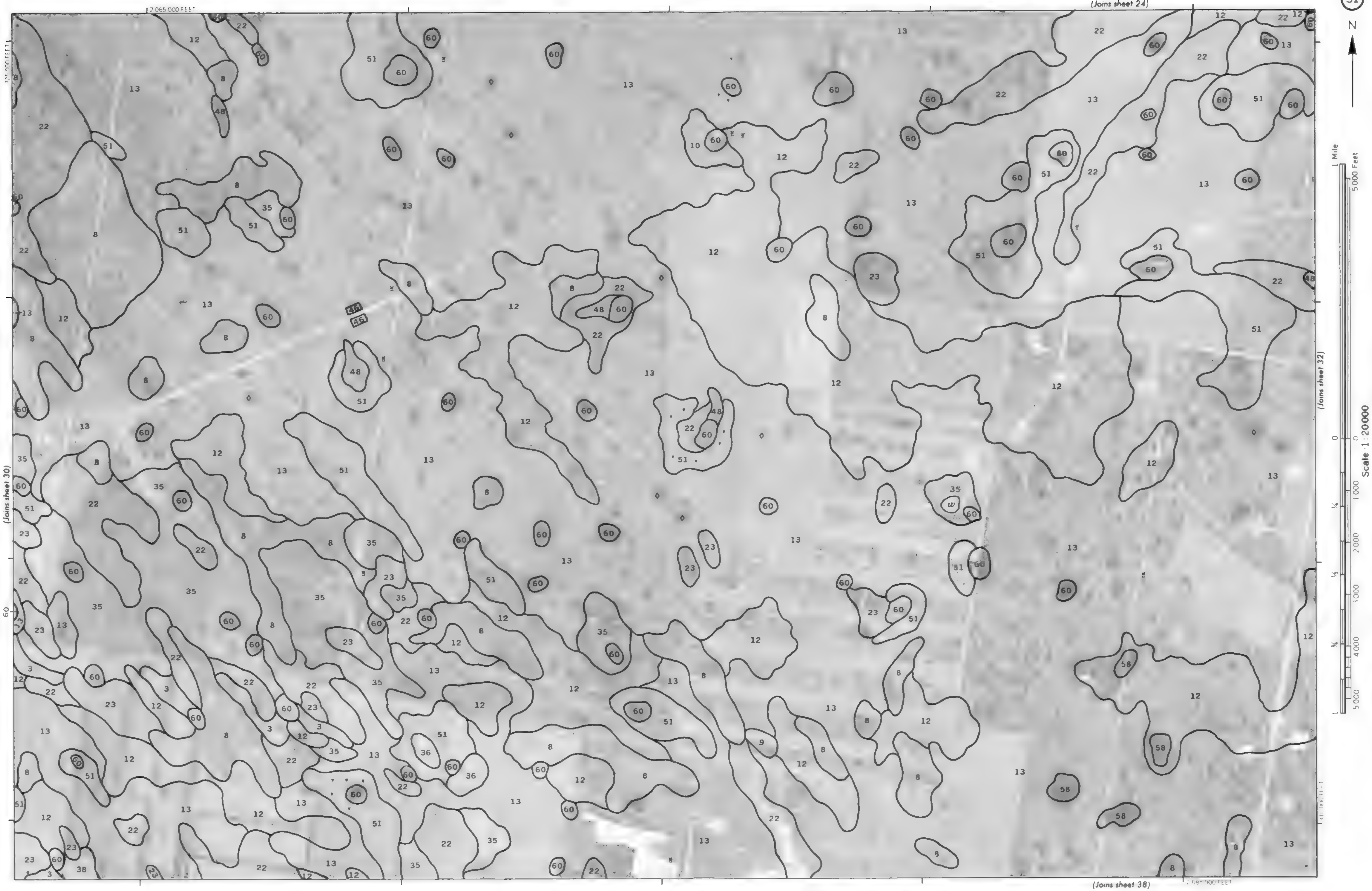
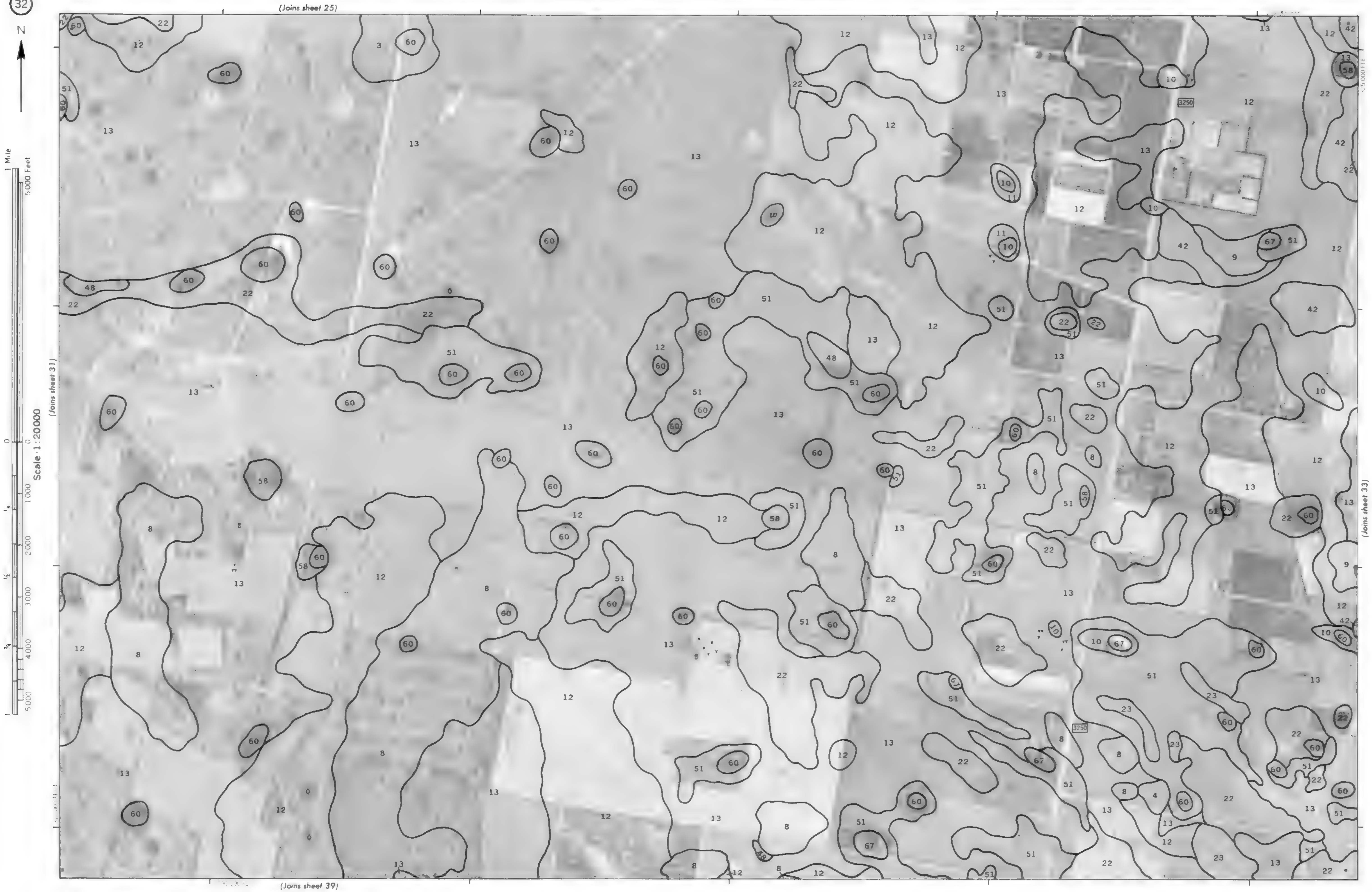
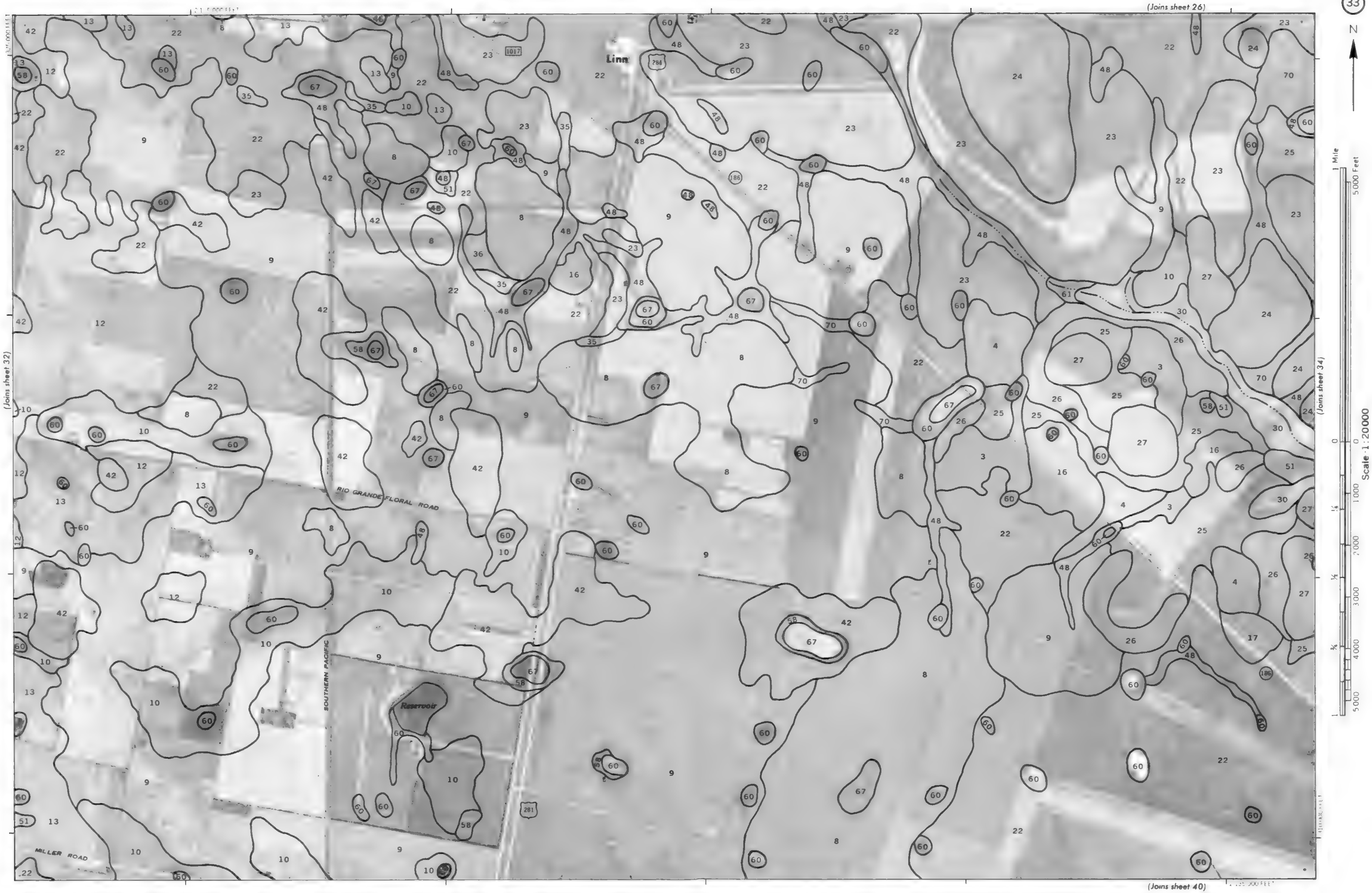

28
N
(Joins sheet 21)
(Joins sheet 27)
(Joins sheet 35)
WILLACY COUNTY
(Joins inset, sheet 21)
(Joins sheet 10)
(Joins inset, sheet 35)
KENEDY COUNTY
LOS CAYOS
DE LA MULA
Scale 1:20000
1 Mile
5000 Feet
2 175 000 FEET
2 165 000 FEET
2 166 000 FEET
2 161 000 FEET

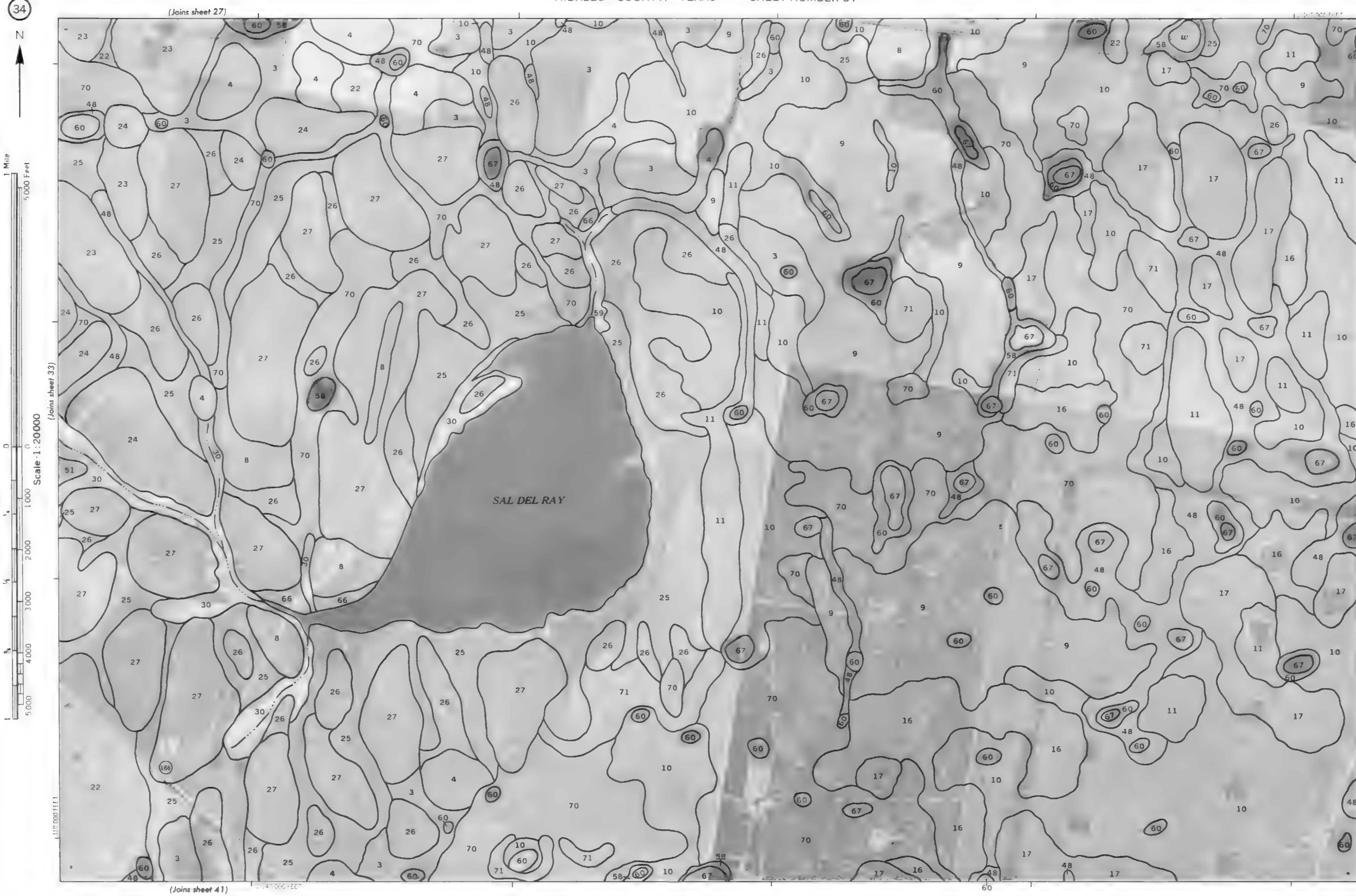

(Joins sheet 22)
(Joins sheet 30)
(Joins sheet 36)
Airfield
STARR COUNTY
N
1 Mile
5000 Feet
Scale 1:20000

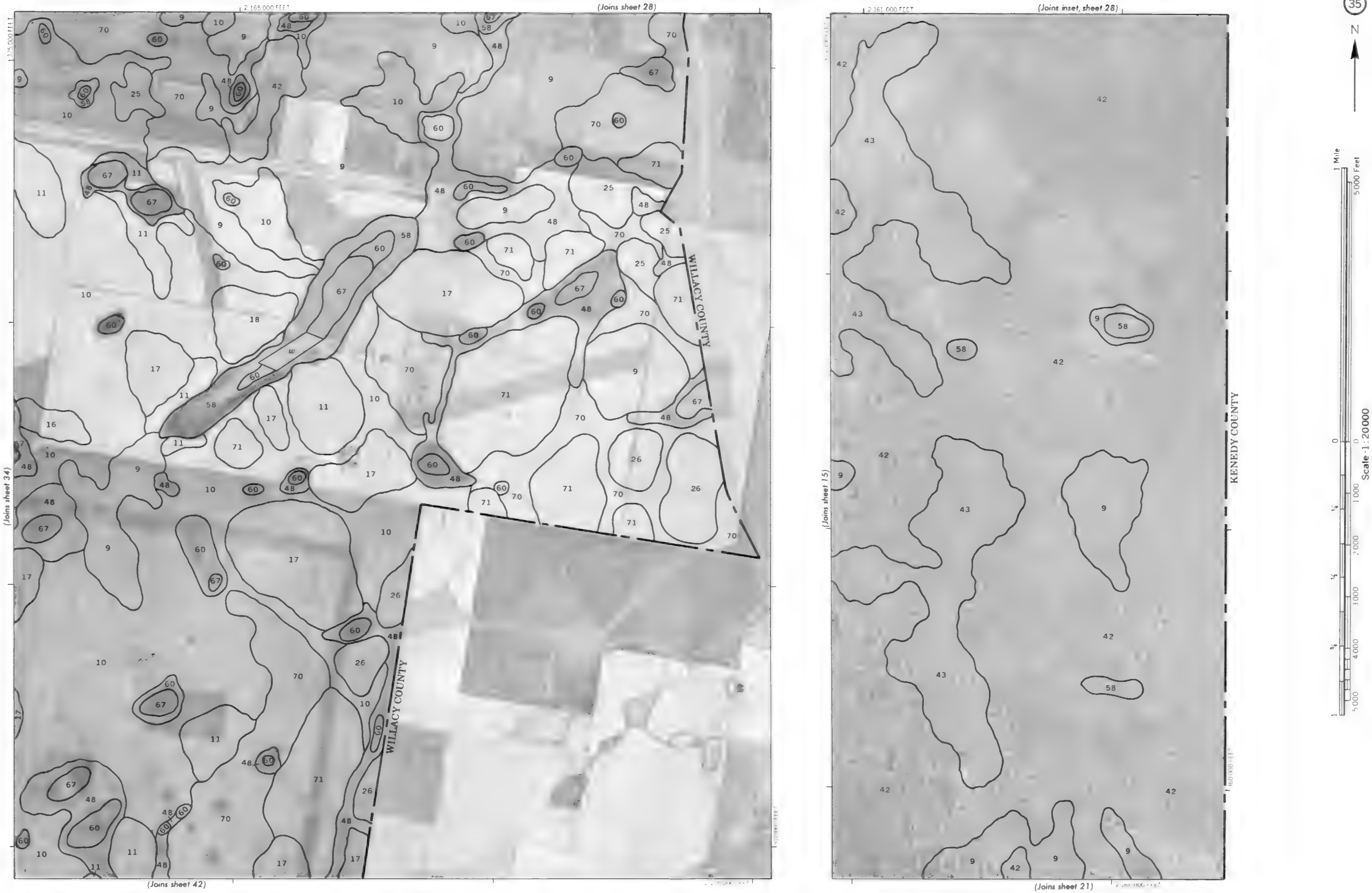

N
(Joins sheet 23)
(Joins sheet 29)
(Joins sheet 31)
(Joins sheet 37)
Scale 1:20000
1 Mile
5000 Feet
681

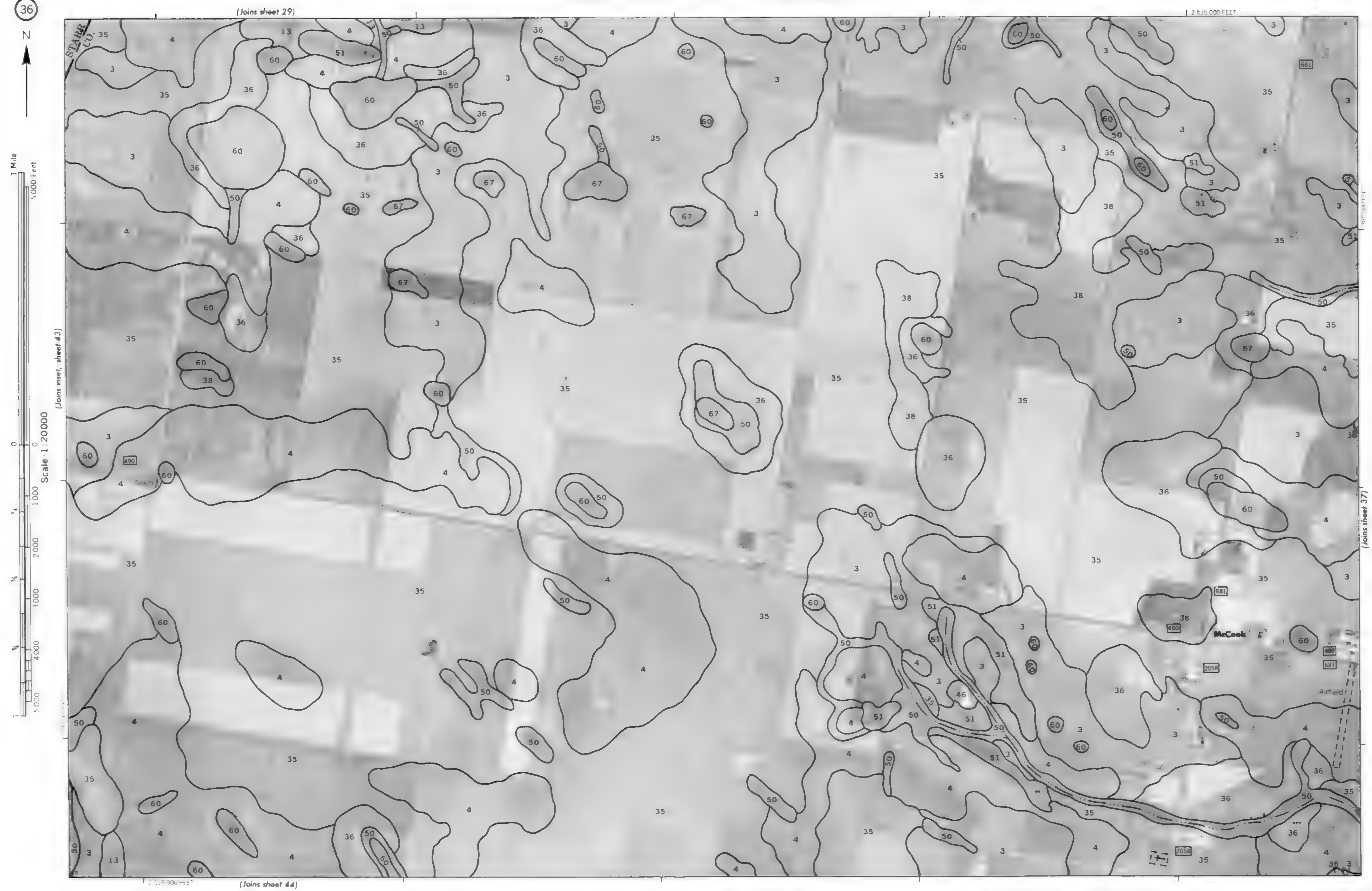

31
(Joins sheet 24)
(Joins sheet 32)
(Joins sheet 30)
(Joins sheet 38)
2 065 000 FEET
N
1 Mile
5000 Feet
Scale 1:20000


(Joins sheet 25)
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 39)
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
3250

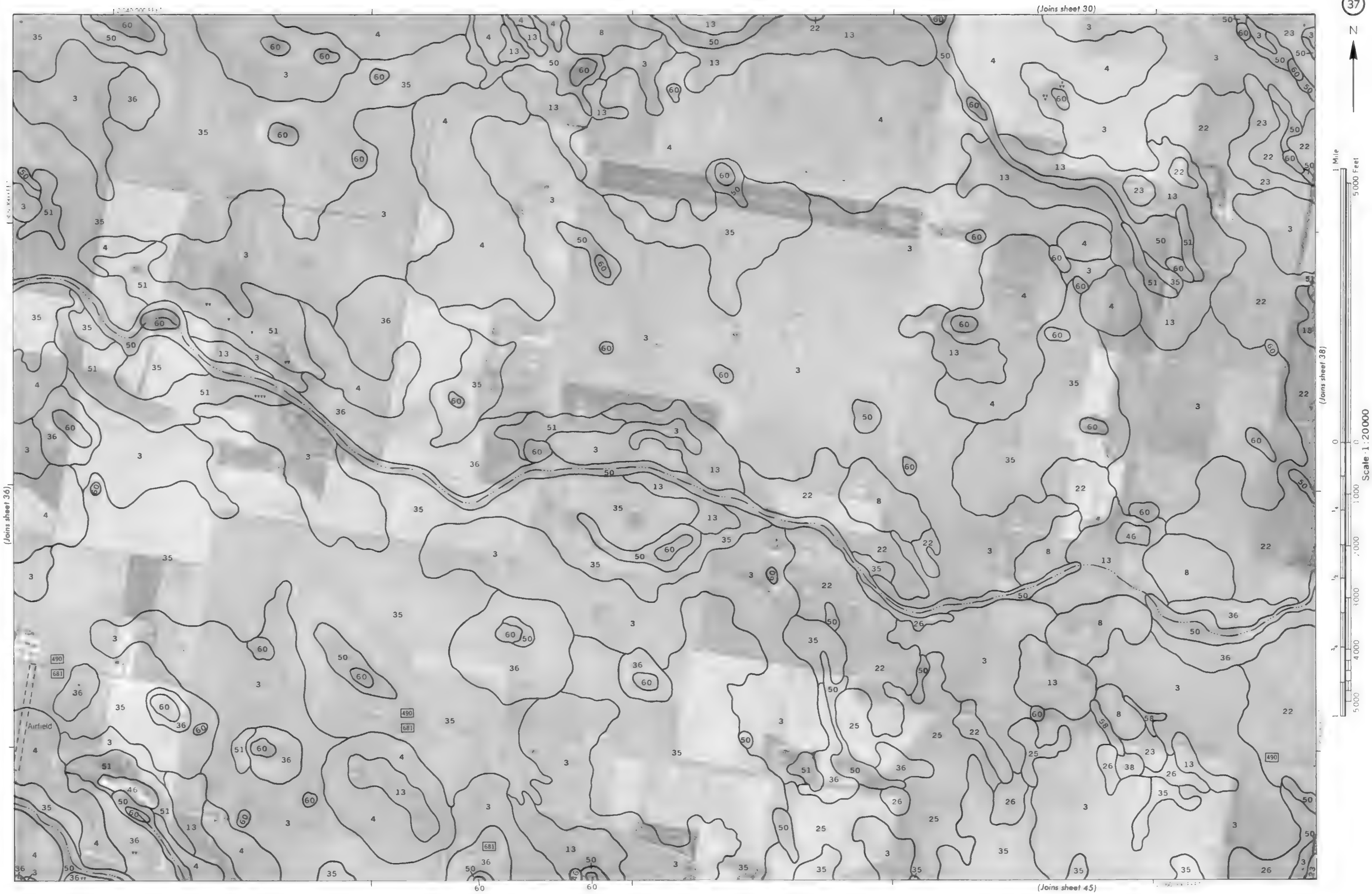

33
N
(Joins sheet 26)
(Joins sheet 32)
(Joins sheet 34)
(Joins sheet 40)
Linn
RIO GRANDE FLORAL ROAD
SOUTHERN PACIFIC
Reservoir
MILLER ROAD
Scale 1:20000
1 Mile
5000 Feet

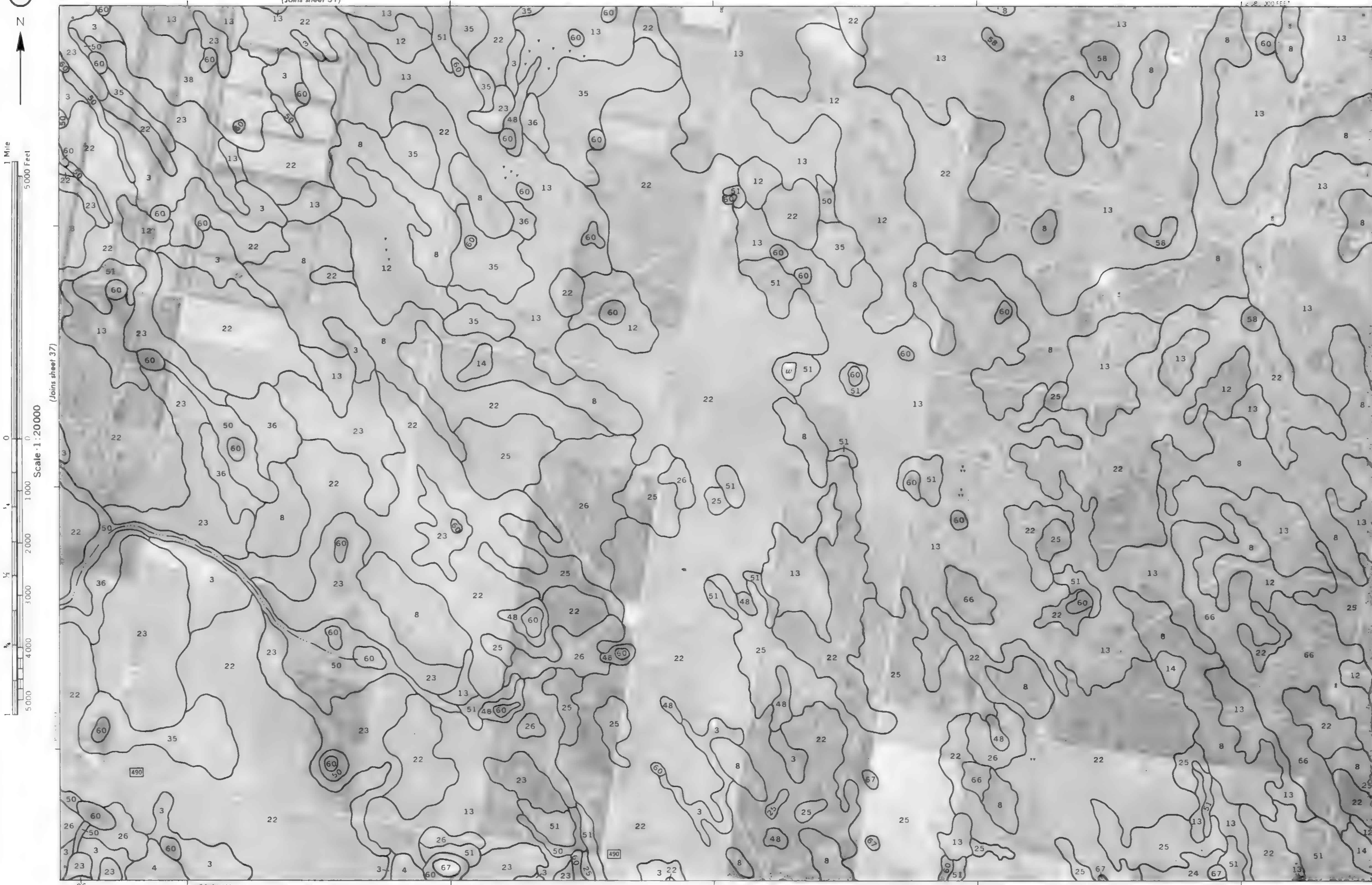

34
N
(Joins sheet 27)
(Joins sheet 33)
(Joins sheet 35)
(Joins sheet 41)
SAL DEL RAY
Scale 1:20000
1 Mile
5000 Feet


(Joins sheet 28)
(Joins inset, sheet 28)
(Joins sheet 34)
(Joins sheet 42)
(Joins sheet 15)
(Joins sheet 21)
WILLACY COUNTY
WILLACY COUNTY
KENEDY COUNTY
35
N
1 Mile
5000 Feet
Scale 1:20000

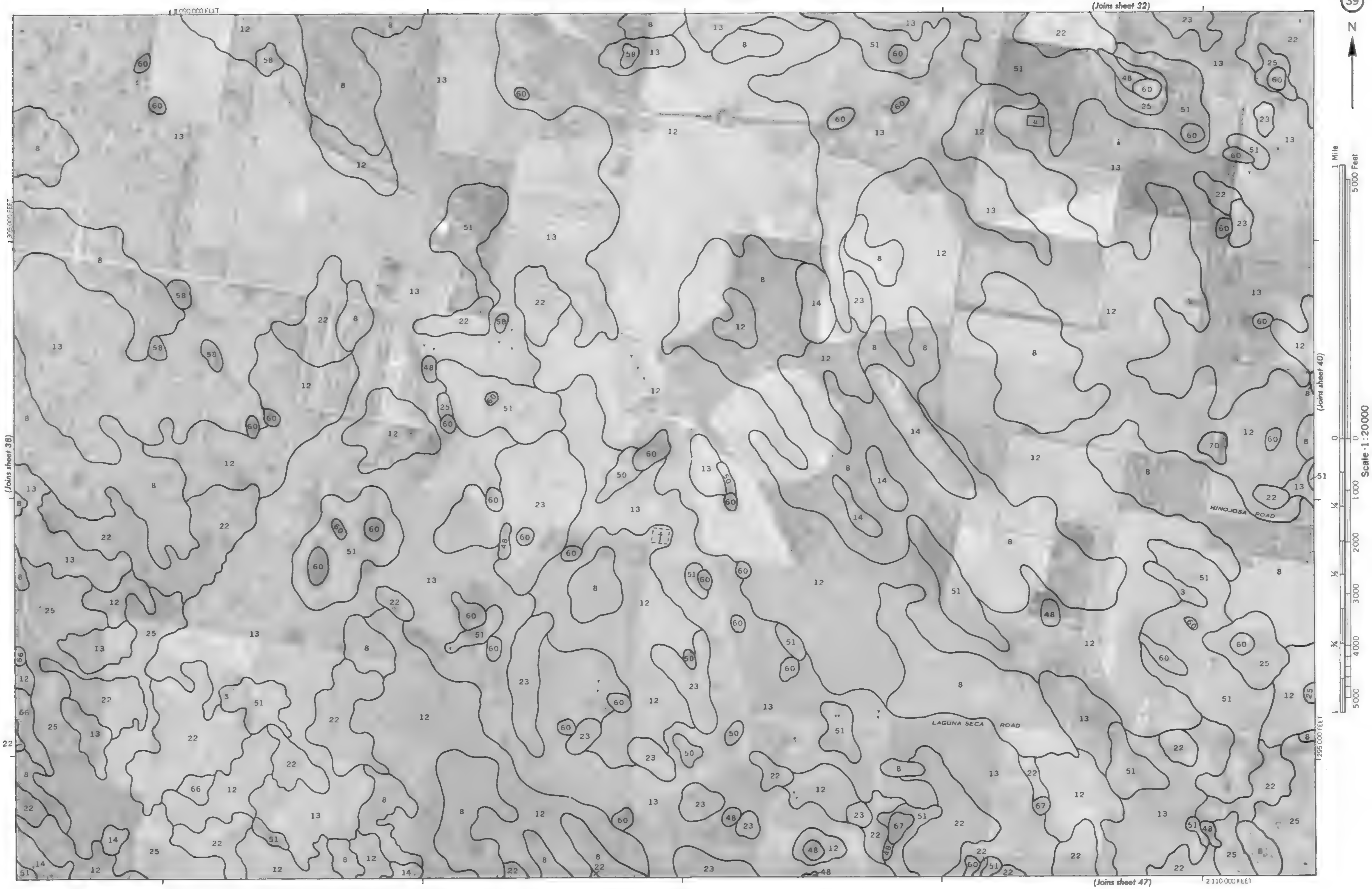


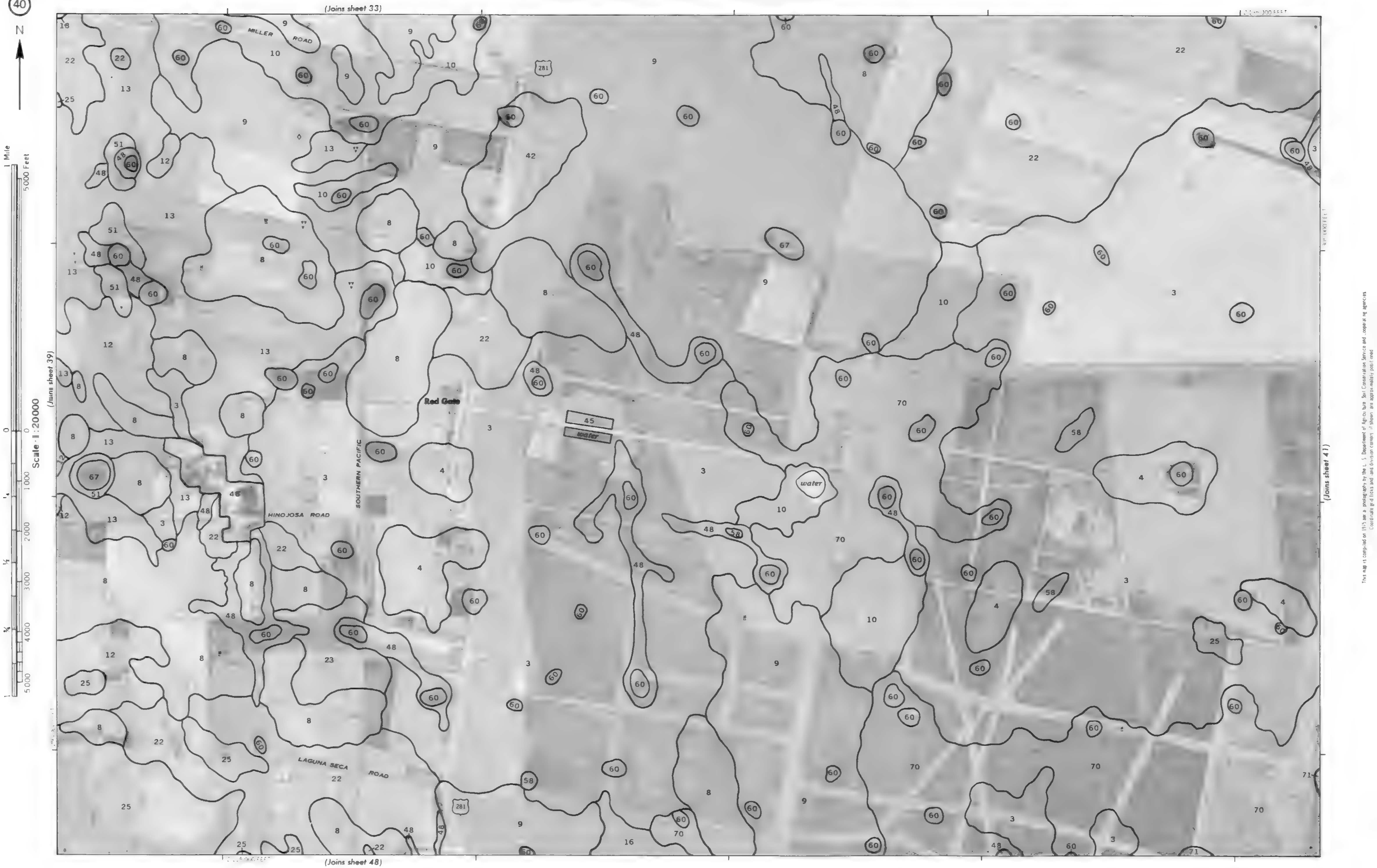
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

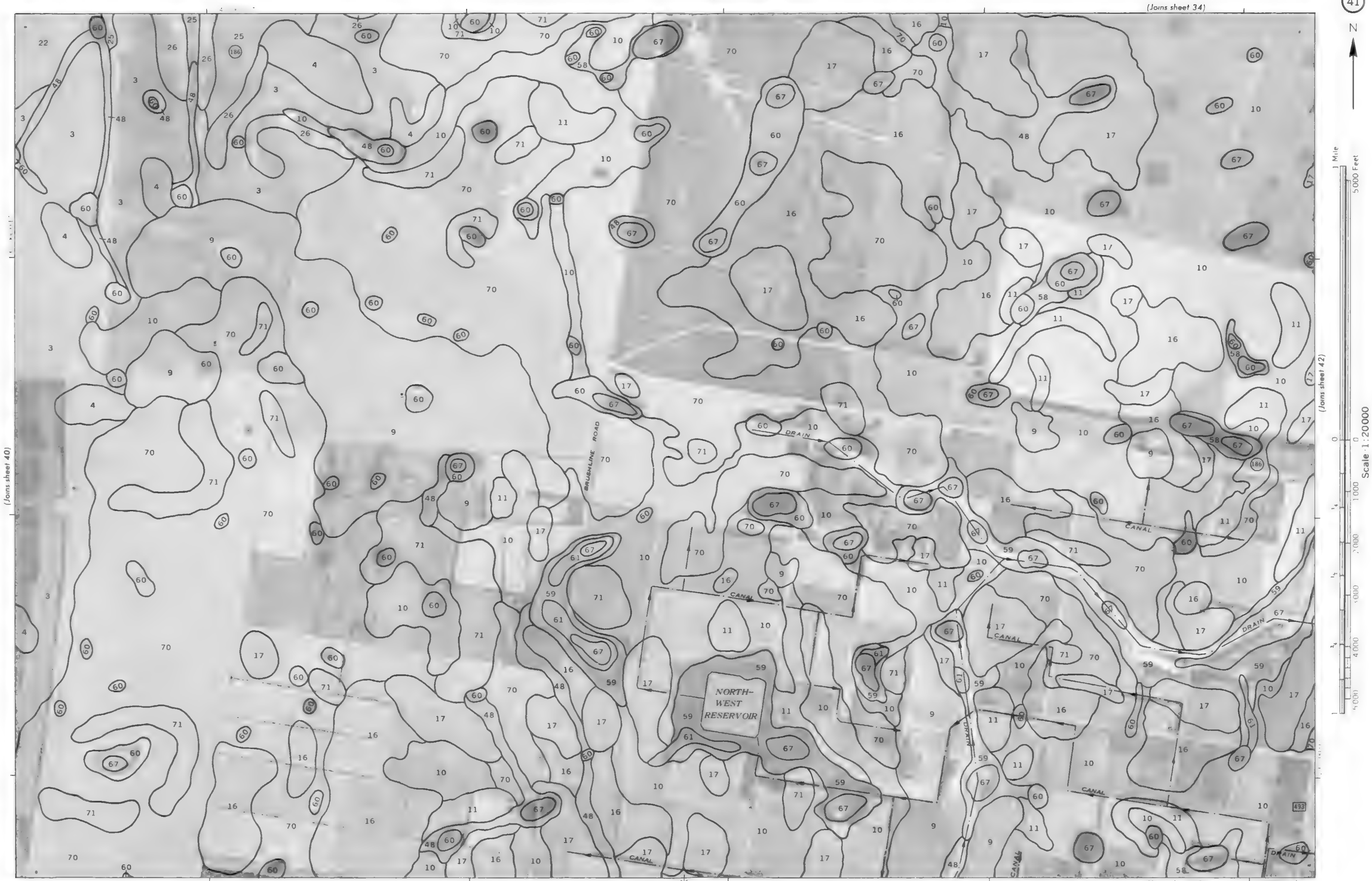

(Joins sheet 30)
(Joins sheet 36)
(Joins sheet 38)
(Joins sheet 45)
Airfield
N
1 Mile
5000 Feet
Scale 1:20000

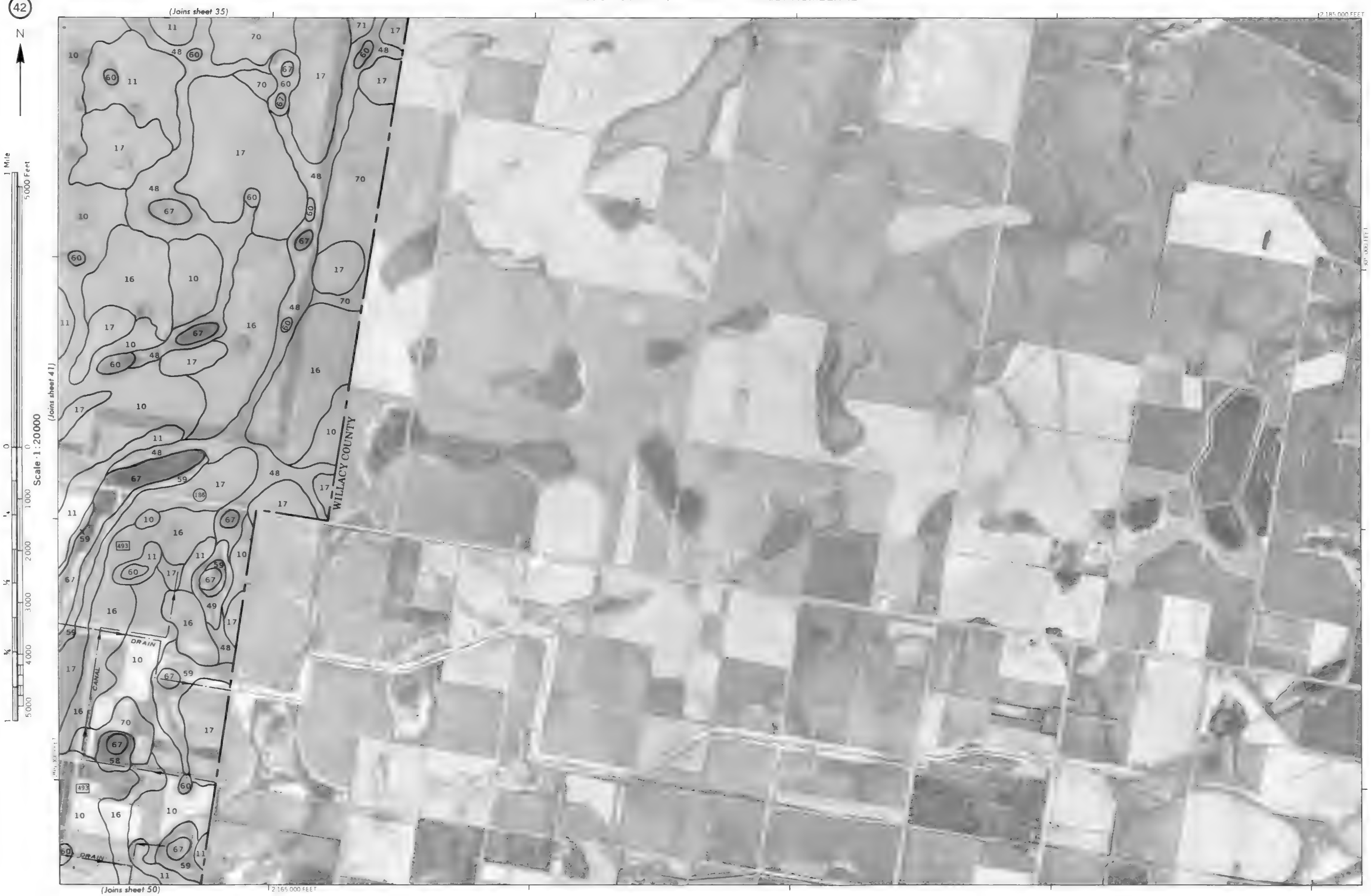

N
(Joins sheet 31)
(Joins sheet 37)
(Joins sheet 39)
(Joins sheet 46)
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
490

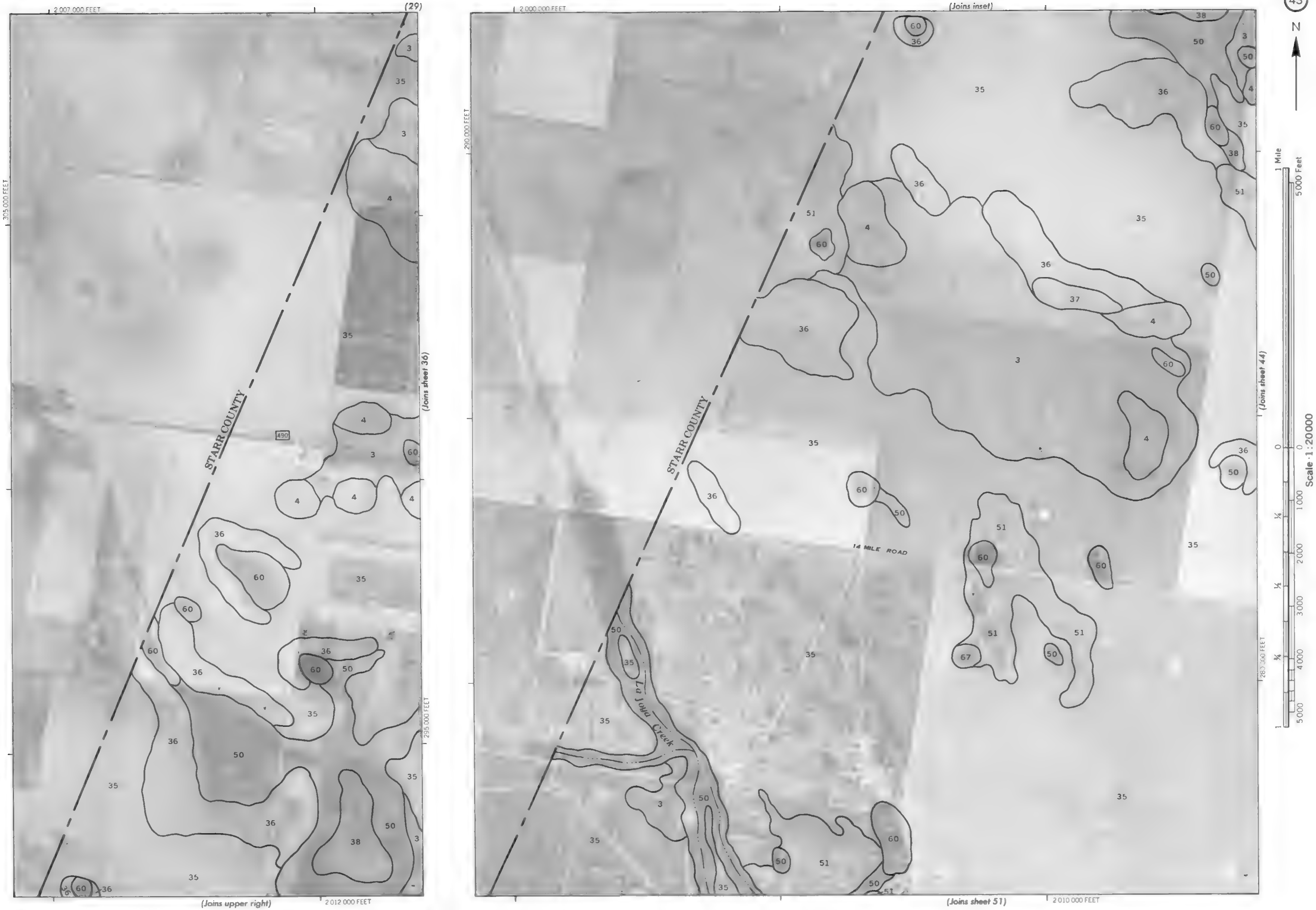
This map is compiled on 1975 aerial photography [redacted] by the U. S. Department of Agriculture, Soil [redacted] Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned



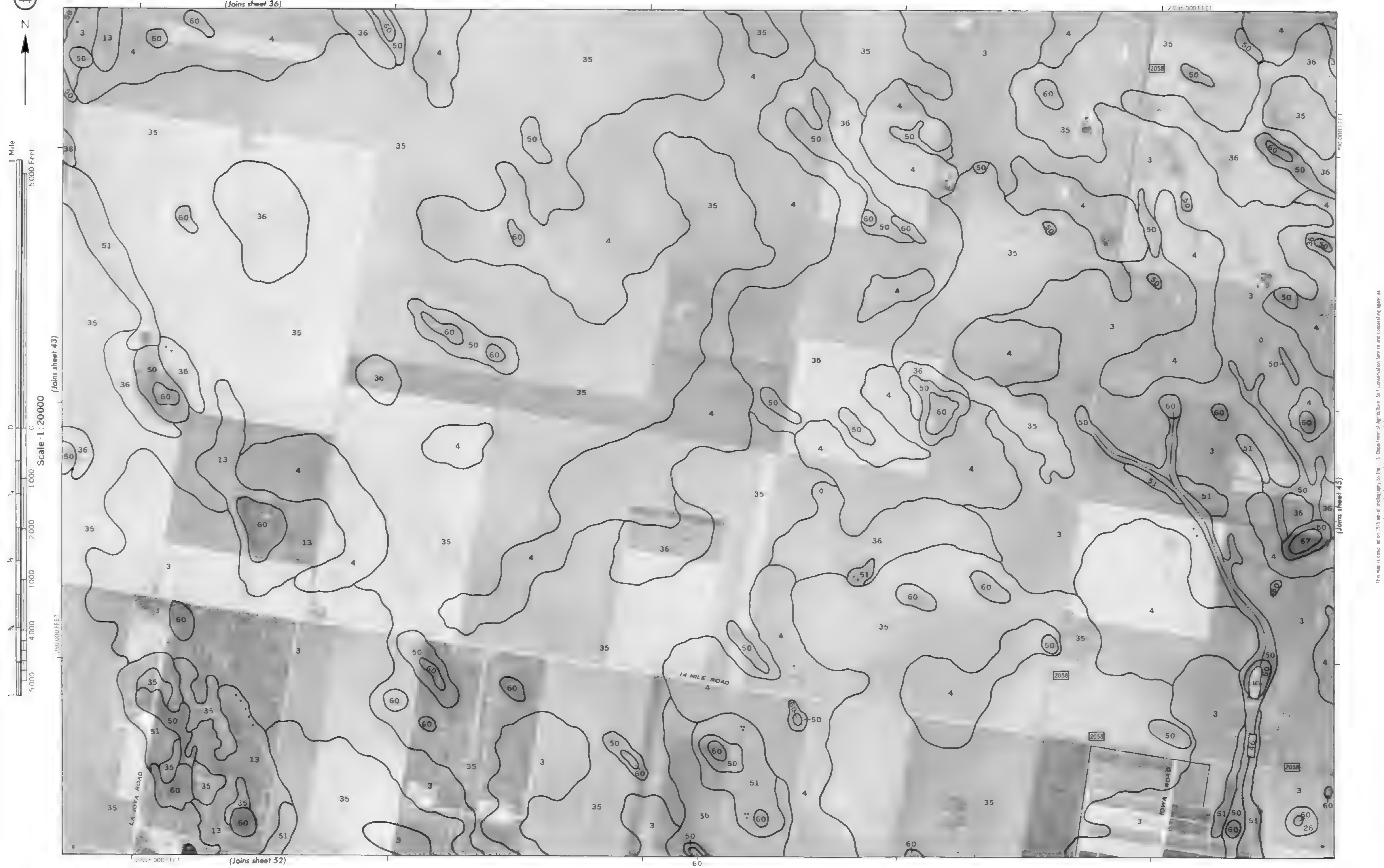

40
N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 33)
(Joins sheet 39)
(Joins sheet 41)
(Joins sheet 48)
MILLER ROAD
HINOJOSA ROAD
SOUTHERN PACIFIC
Red Gate
LAGUNA SECA ROAD
281
water

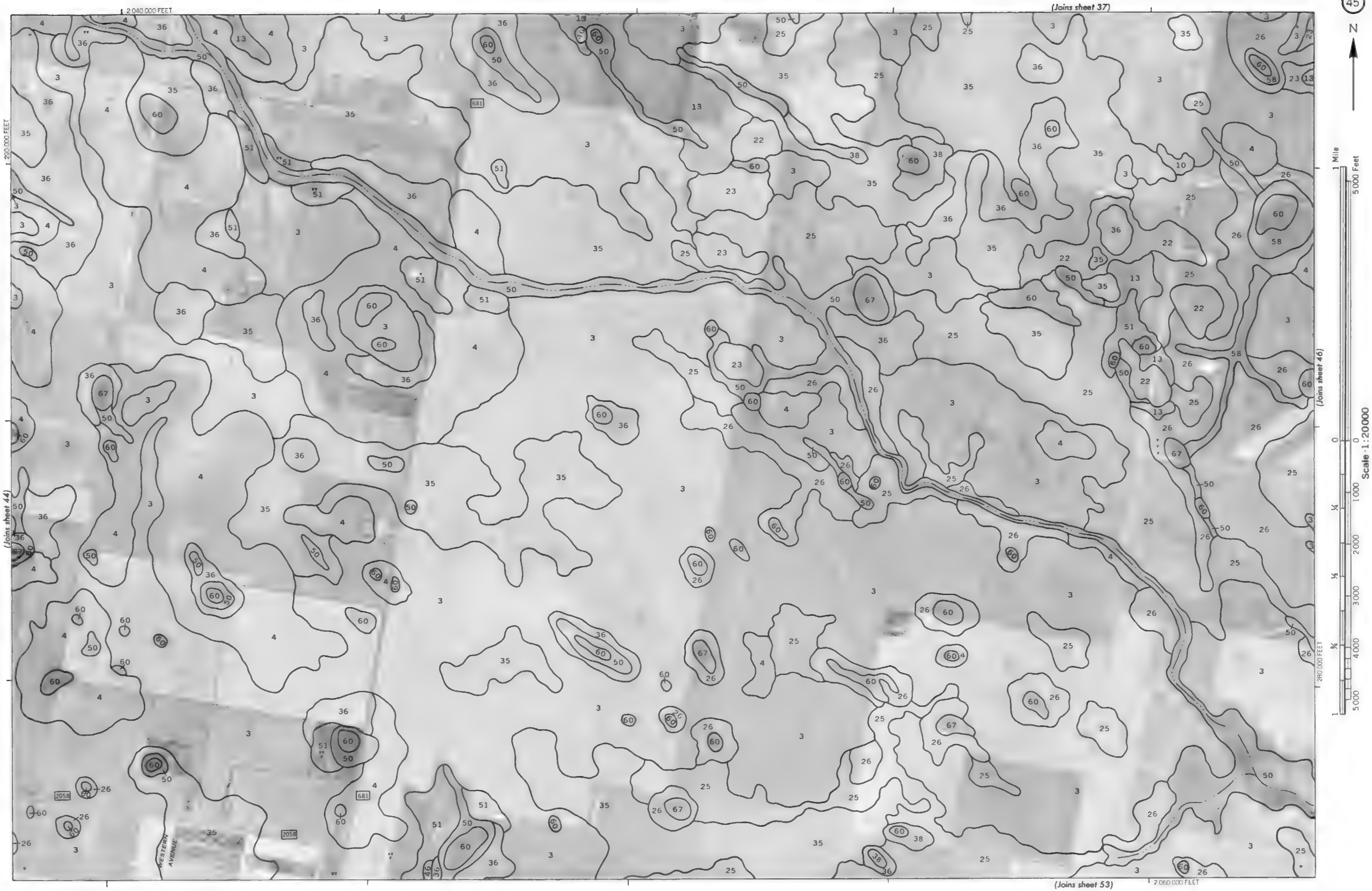

(Joins sheet 34)
(Joins sheet 40)
(Joins sheet 42)
(Joins sheet 49)
N
BRUSHLINE ROAD
NORTH-WEST RESERVOIR
CANAL
DRAIN
1 Mile
5000 Feet
Scale 1:20000


(Joins sheet 35)
(Joins sheet 41)
(Joins sheet 50)
WILLACY COUNTY
DRAIN
CANAL
N
Scale 1:20000
1 Mile
5000 Feet
2 185 000 FEET
2 165 000 FEET

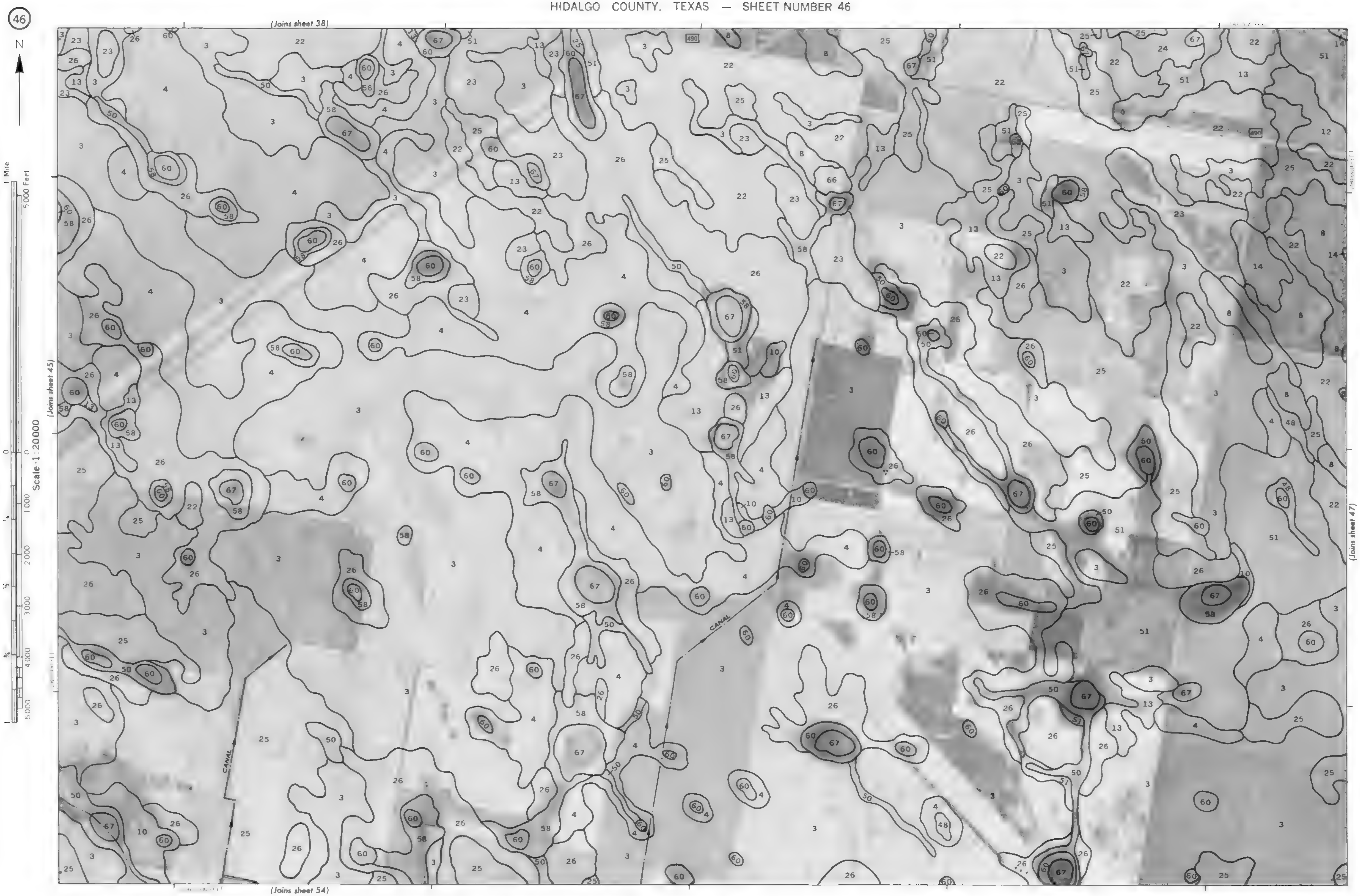


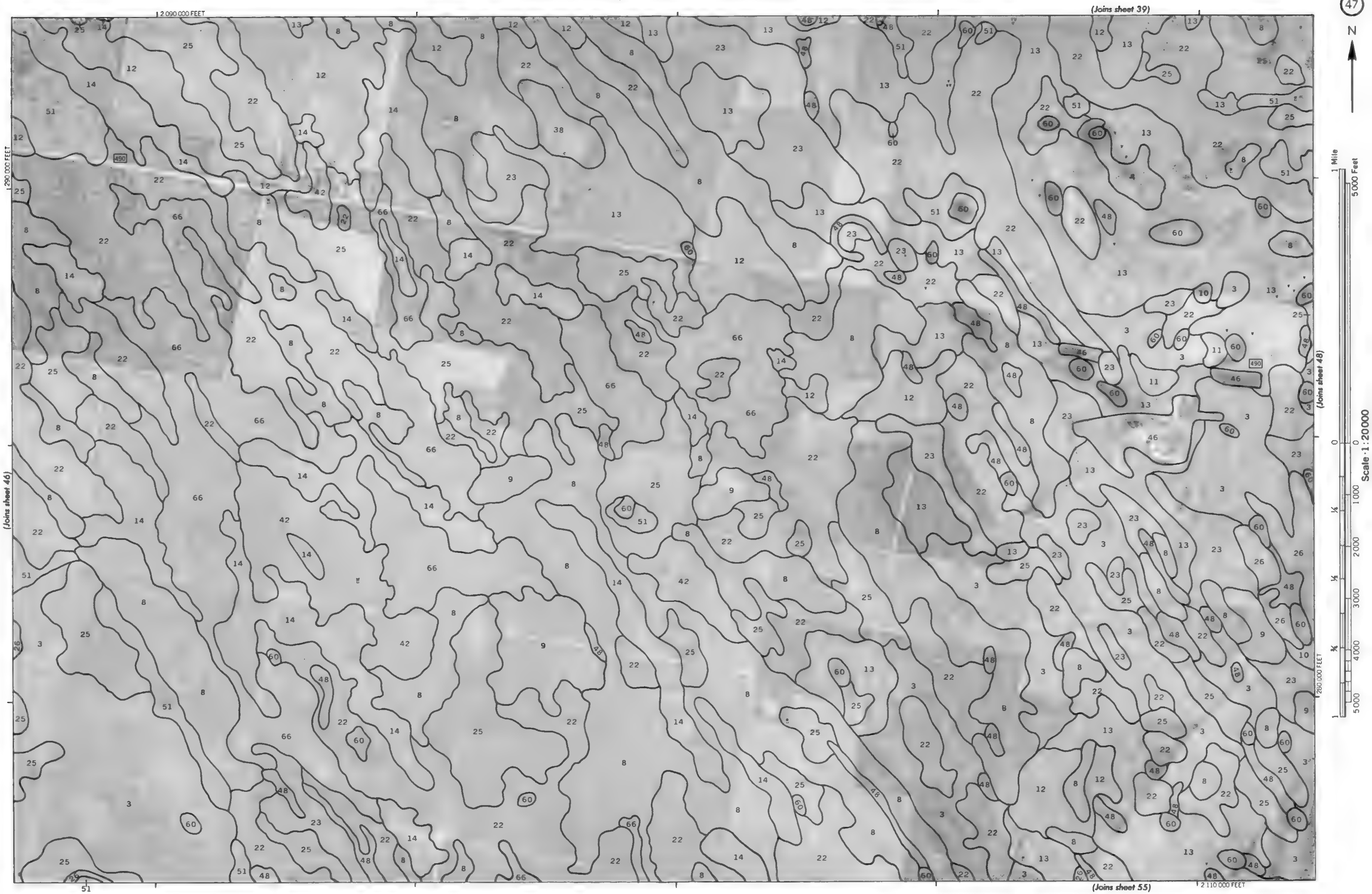
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
(Joins sheet 36)
(Joins sheet 43)
(Joins sheet 45)
(Joins sheet 52)
Scale 1:20000
1 Mile
5000 Feet
14 MILE ROAD
LA JOYA ROAD
IOWA ROAD
2058
This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

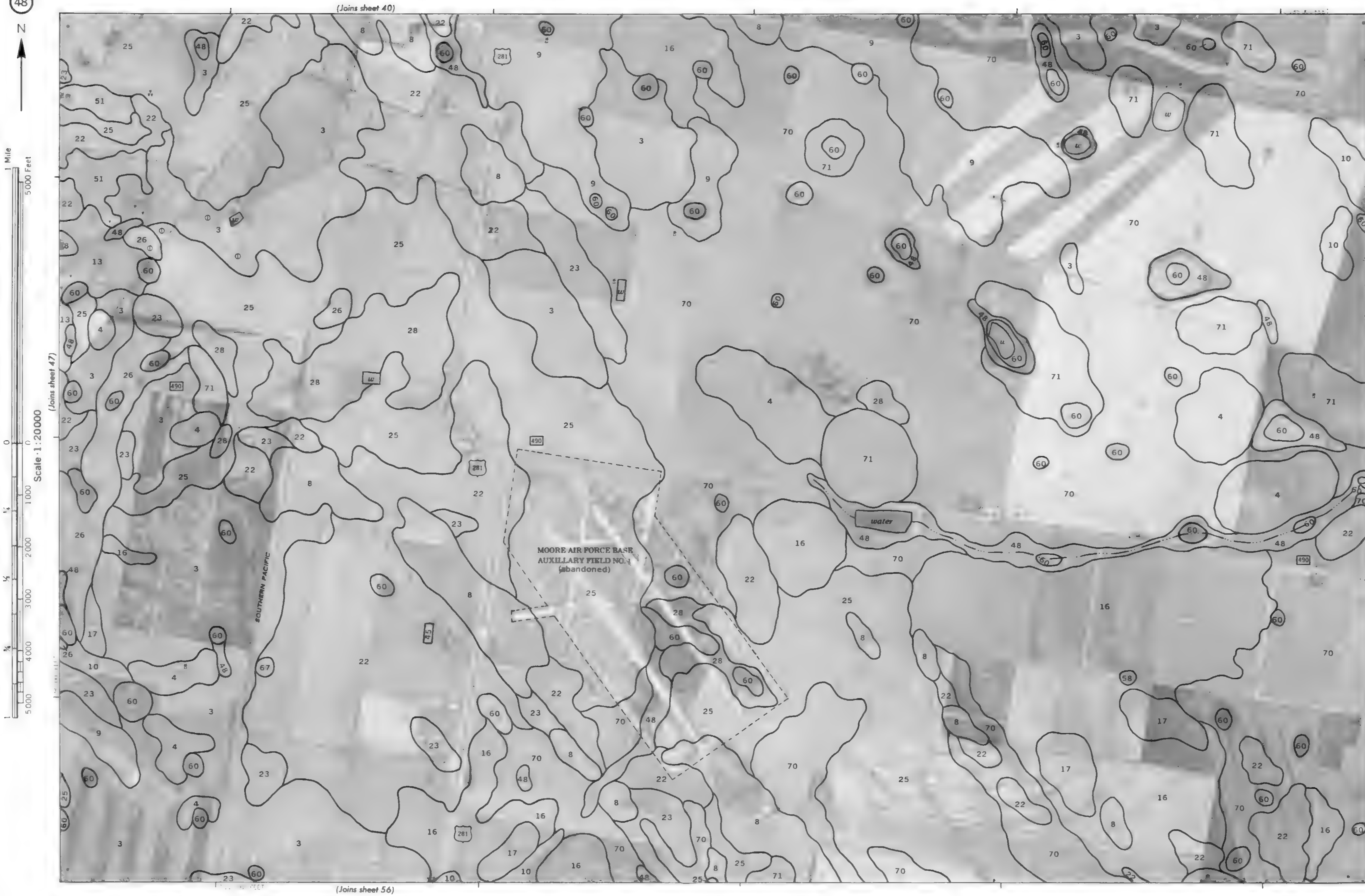


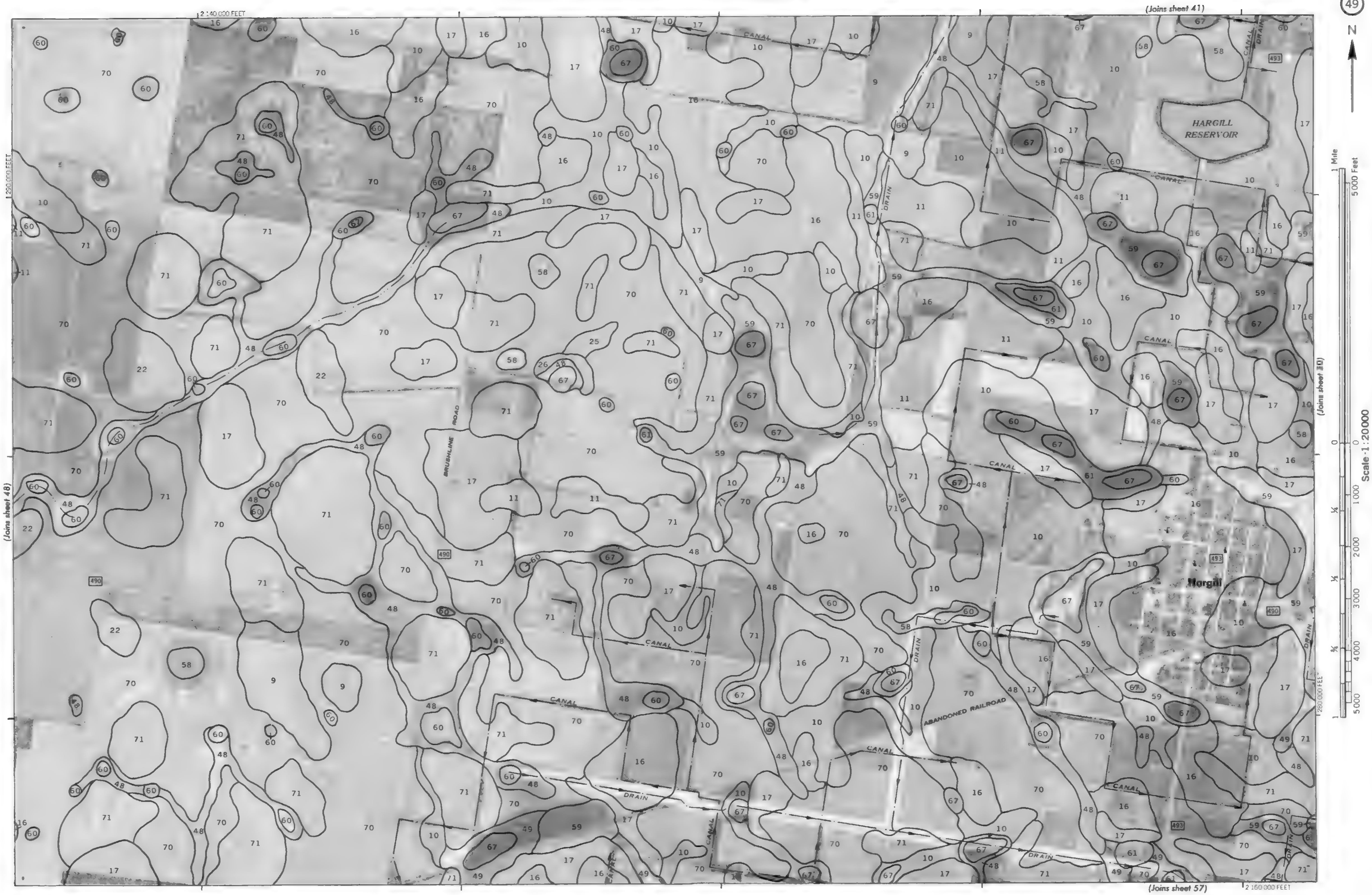
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


46
N
(Joins sheet 38)
(Joins sheet 45)
(Joins sheet 47)
(Joins sheet 54)
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
CANAL
CANAL
CANAL
490



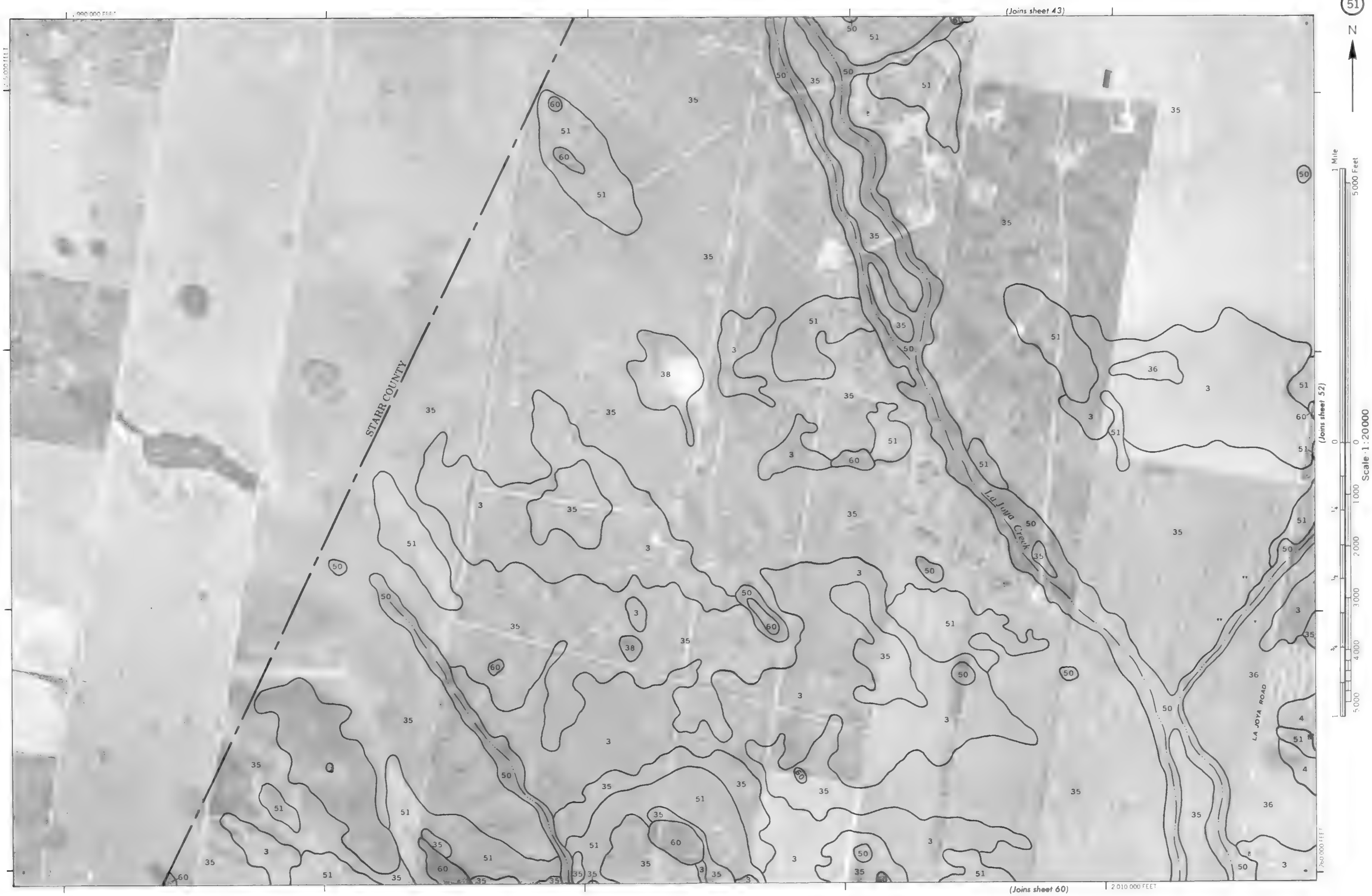
This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


(Joins sheet 40)
(Joins sheet 47)
(Joins sheet 49)
(Joins sheet 56)
N
Scale 1:20000
1 Mile
5000 Feet
MOORE AIR FORCE BASE
AUXILIARY FIELD NO. 1
(abandoned)
SOUTHERN PACIFIC
water



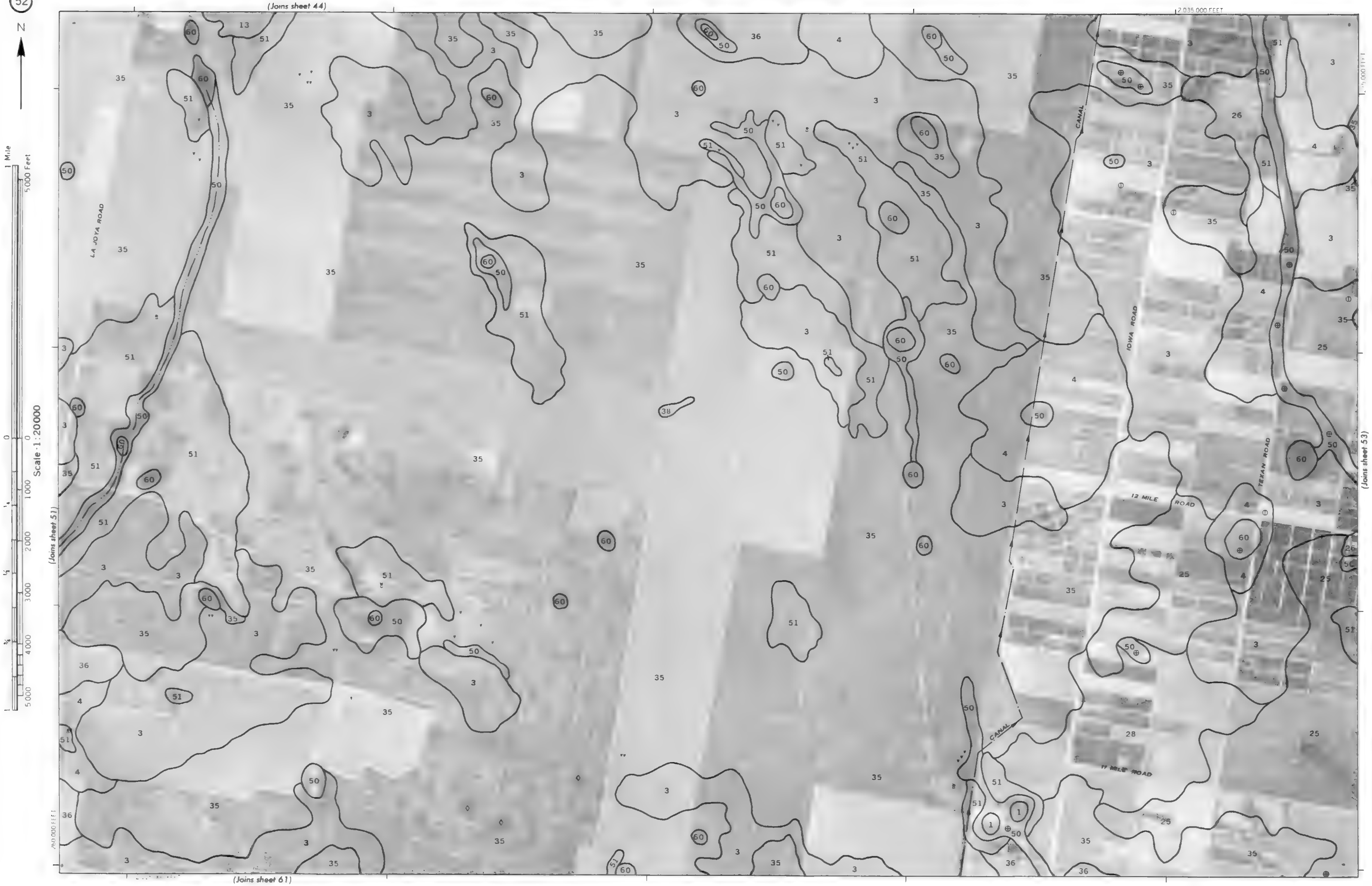
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


50
N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 42)
(Joins sheet 49)
(Joins sheet 58)
(Joins inset, sheet 124)
WILLACY COUNTY
WILLACY COUNTY
COUNTY LINE ROAD
ABANDONED RAILROAD
ABANDONED RAILROAD
CANAL
DRAIN
DELTA LAKE
2 165 000 FEET
280 000 FEET
290 000 FEET

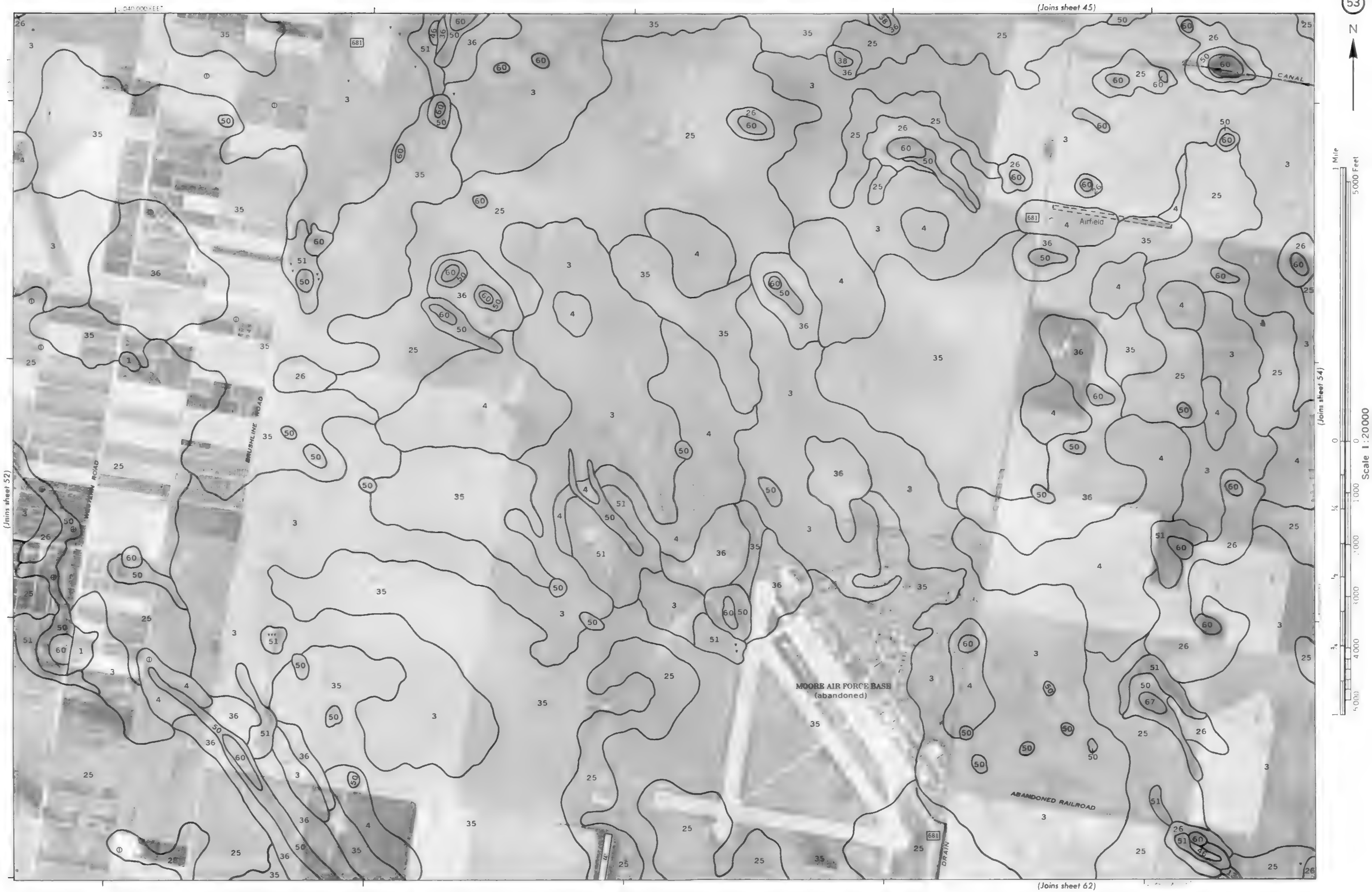


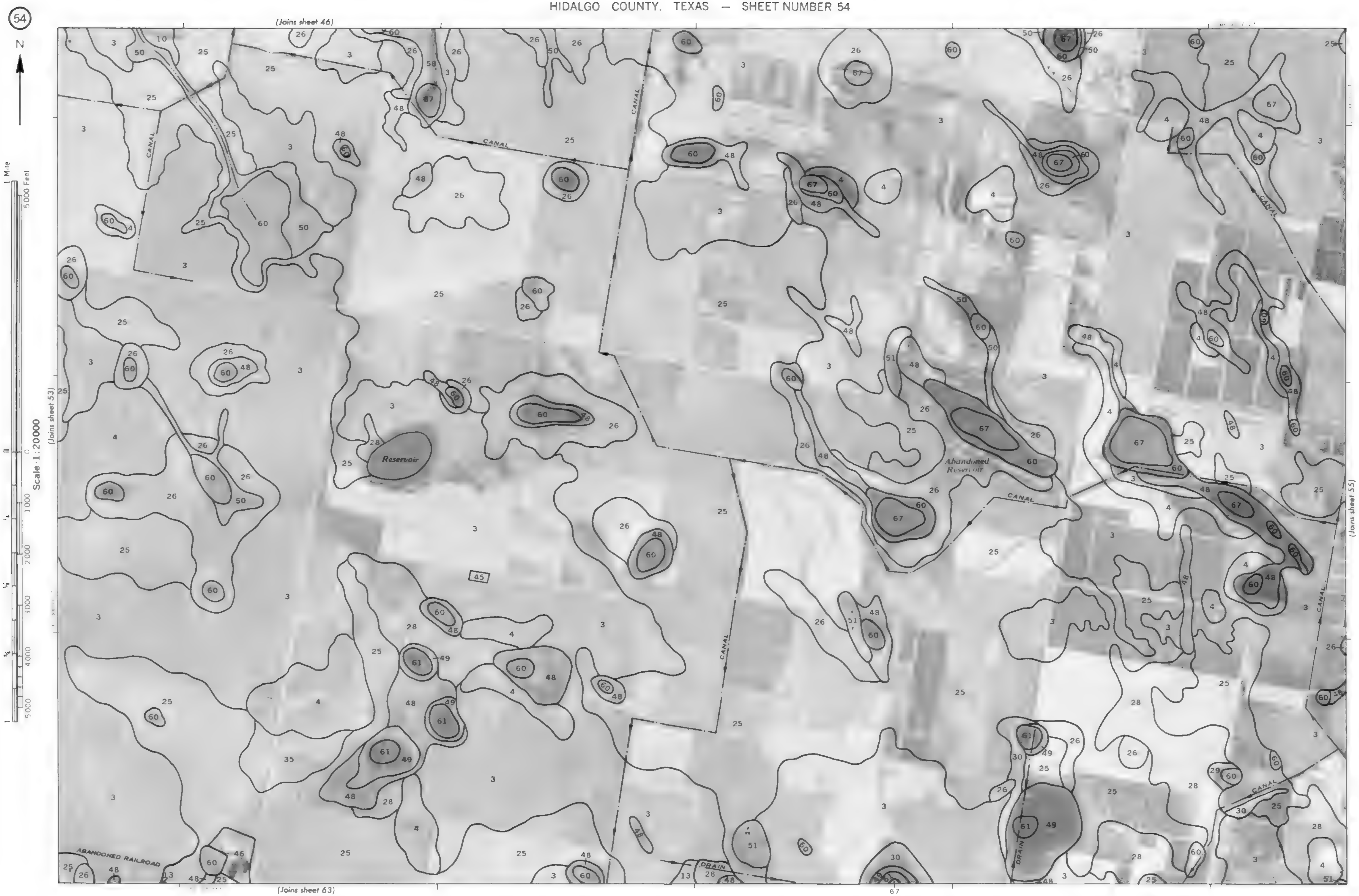
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

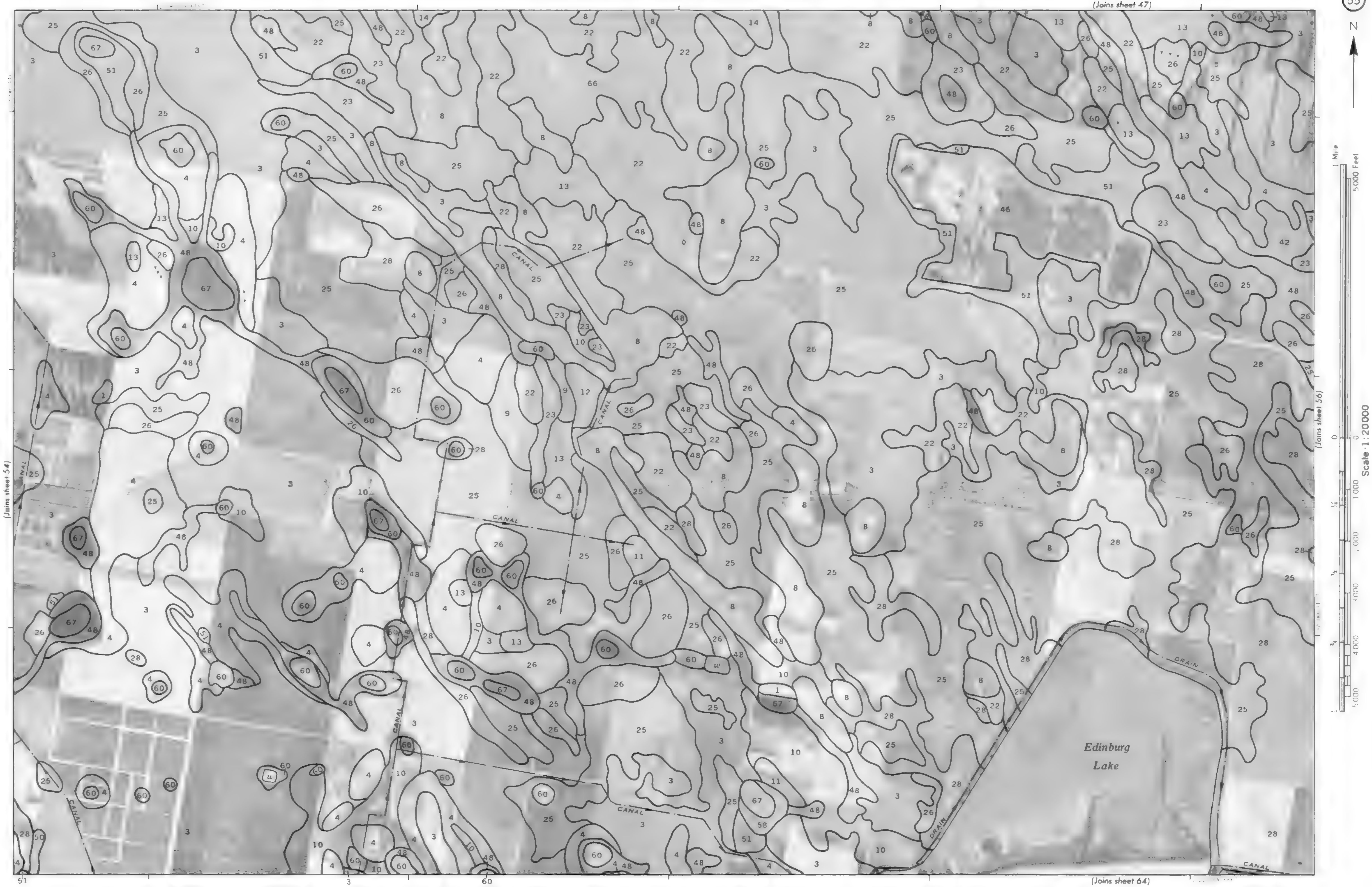
HIDALGO COUNTY, TEXAS — SHEET NUMBER 52

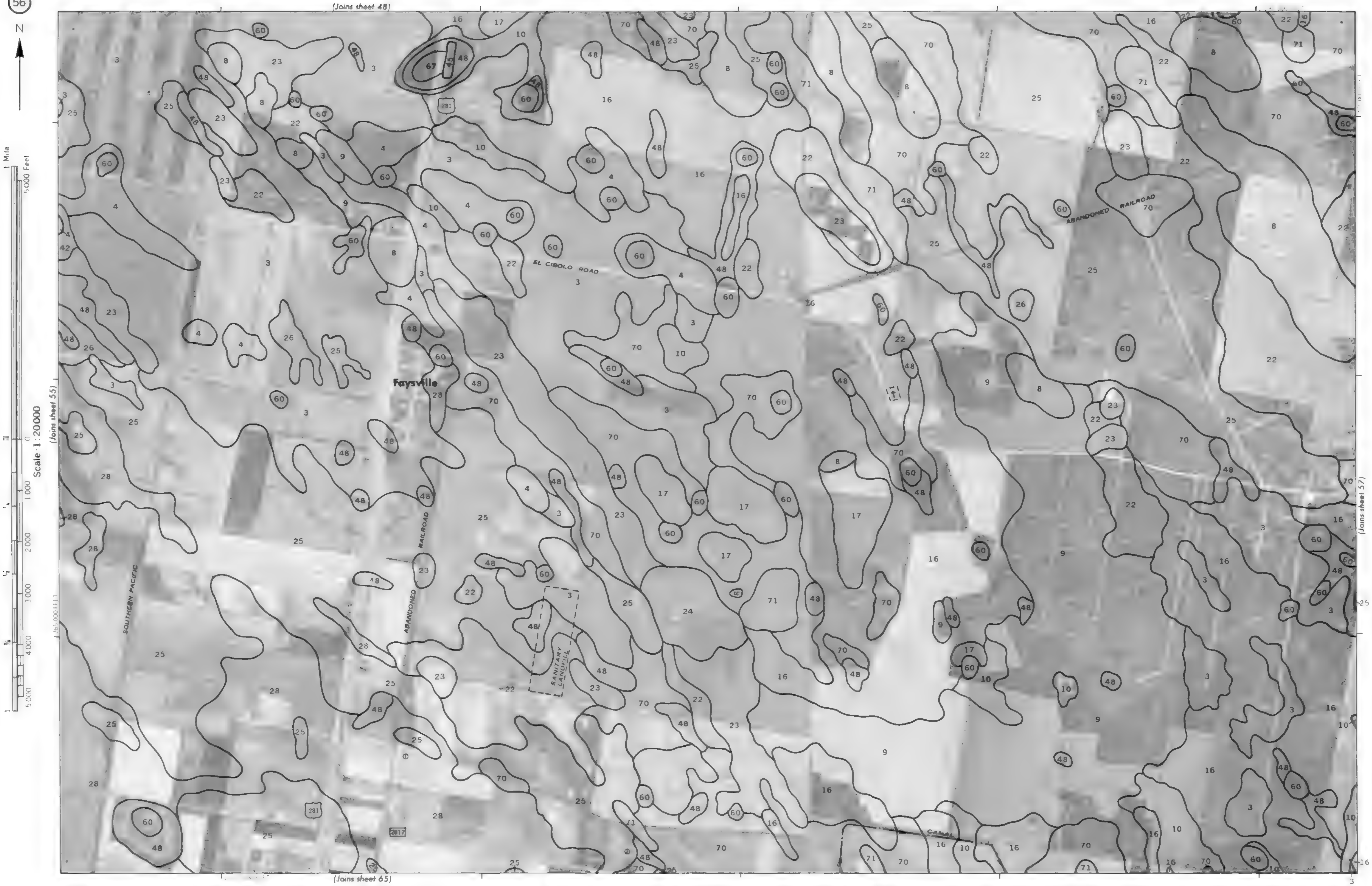


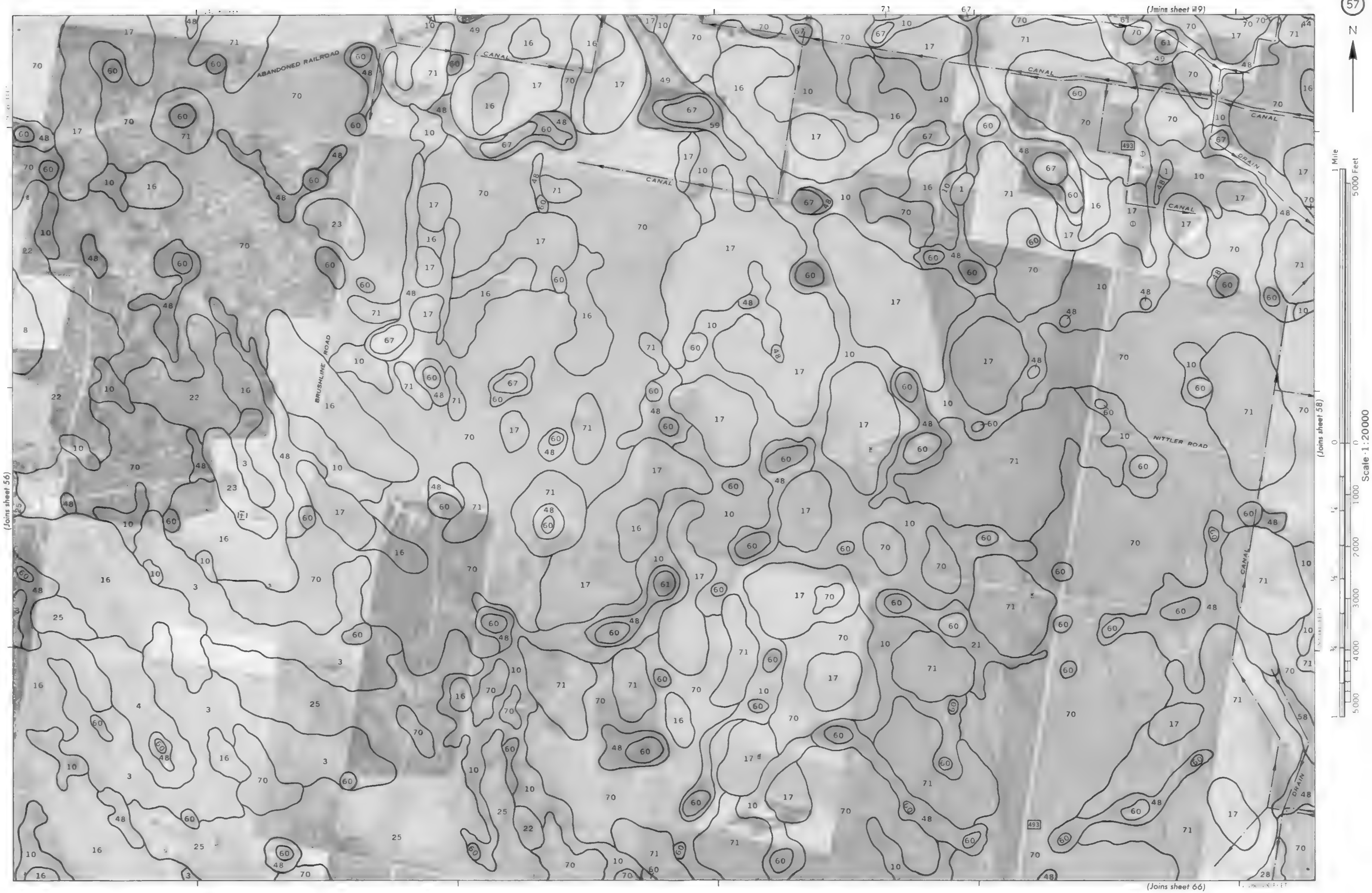
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


(Joins sheet 45)
(Joins sheet 54)
(Joins sheet 62)
(Joins sheet 52)
N
Scale 1:20000
1 Mile
5000 Feet
CANAL
Airfield
BRUSHLINE ROAD
MOORE AIR FORCE BASE
(abandoned)
ABANDONED RAILROAD
DRAIN

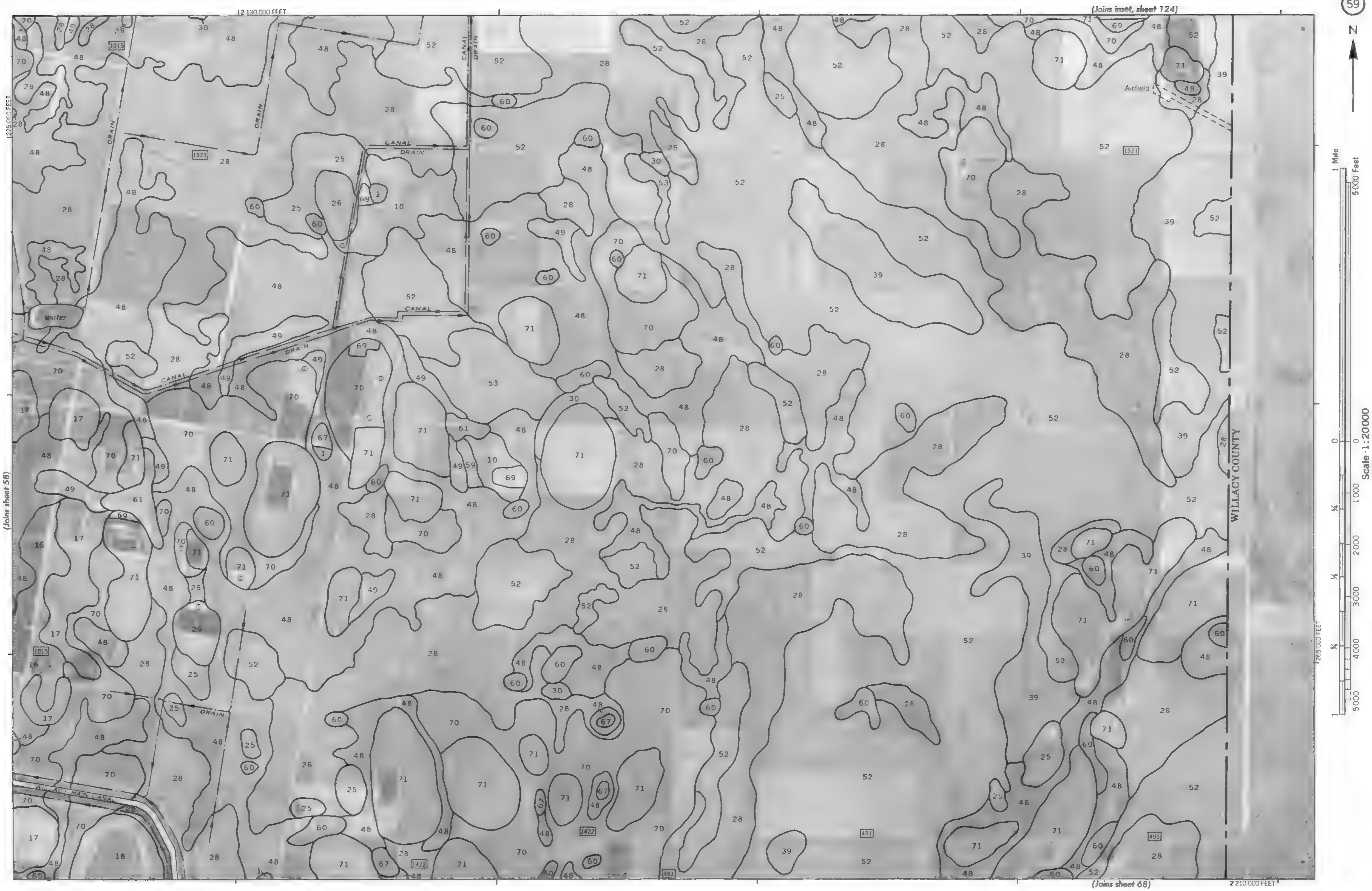

54
N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 46)
(Joins sheet 53)
(Joins sheet 55)
(Joins sheet 63)
CANAL
Reservoir
Abandoned Reservoir
ABANDONED RAILROAD
DRAIN
45
67


(Joins sheet 47)
(Joins sheet 54)
(Joins sheet 56)
(Joins sheet 64)
Edinburg
Lake
CANAL
DRAIN
N
1 Mile
5000 Feet
Scale 1:20000

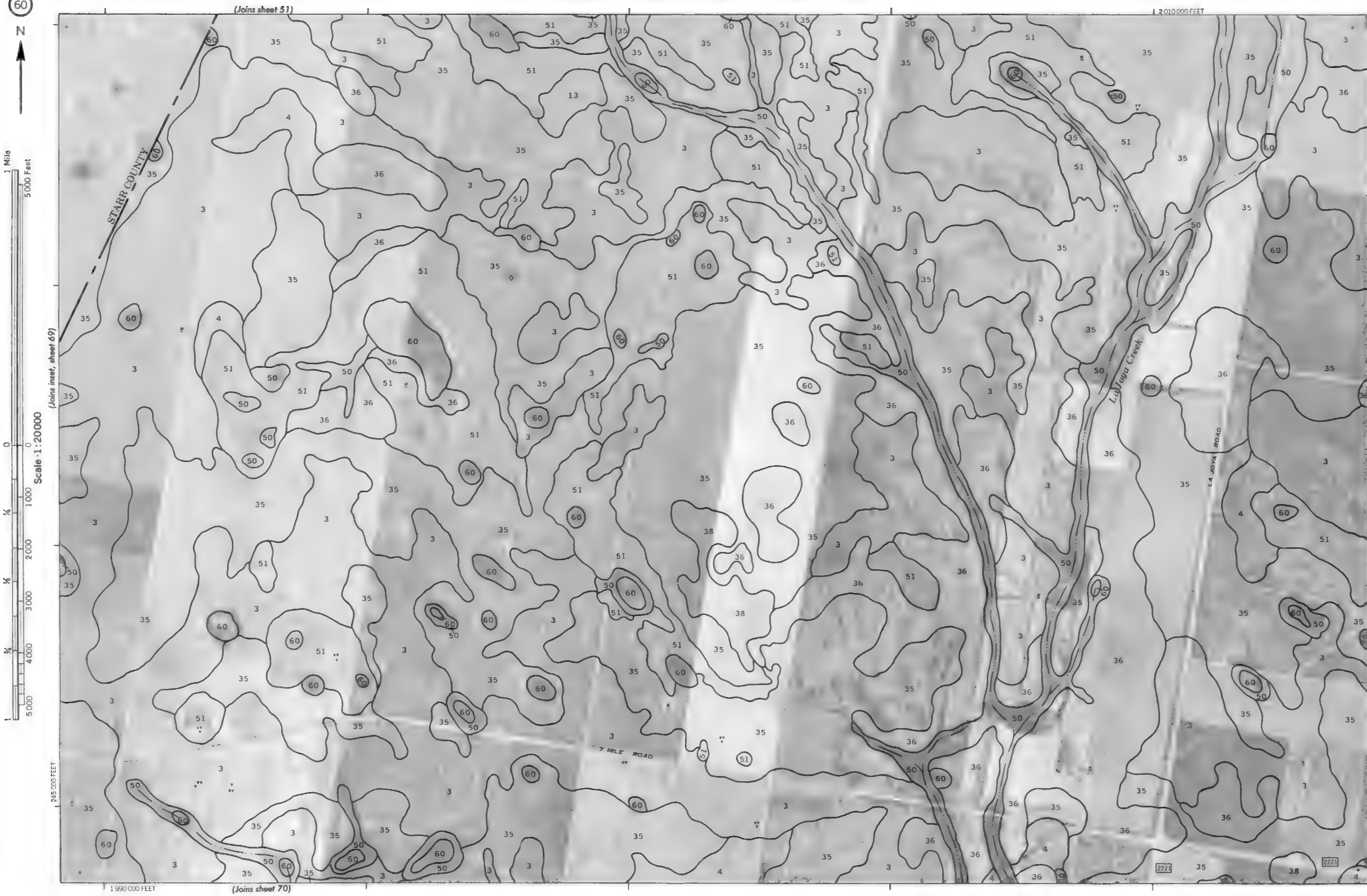

N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 48)
(Joins sheet 55)
(Joins sheet 57)
(Joins sheet 65)
Faysville
EL CIBOLO ROAD
ABANDONED RAILROAD
SOUTHERN PACIFIC
SANITARY LANDFILL
CANAL


57
N
(Joins sheet 49)
ABANDONED RAILROAD
CANAL
DRAIN
BRUSHLINE ROAD
NITTLER ROAD
493
(Joins sheet 58)
(Joins sheet 56)
(Joins sheet 66)
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000

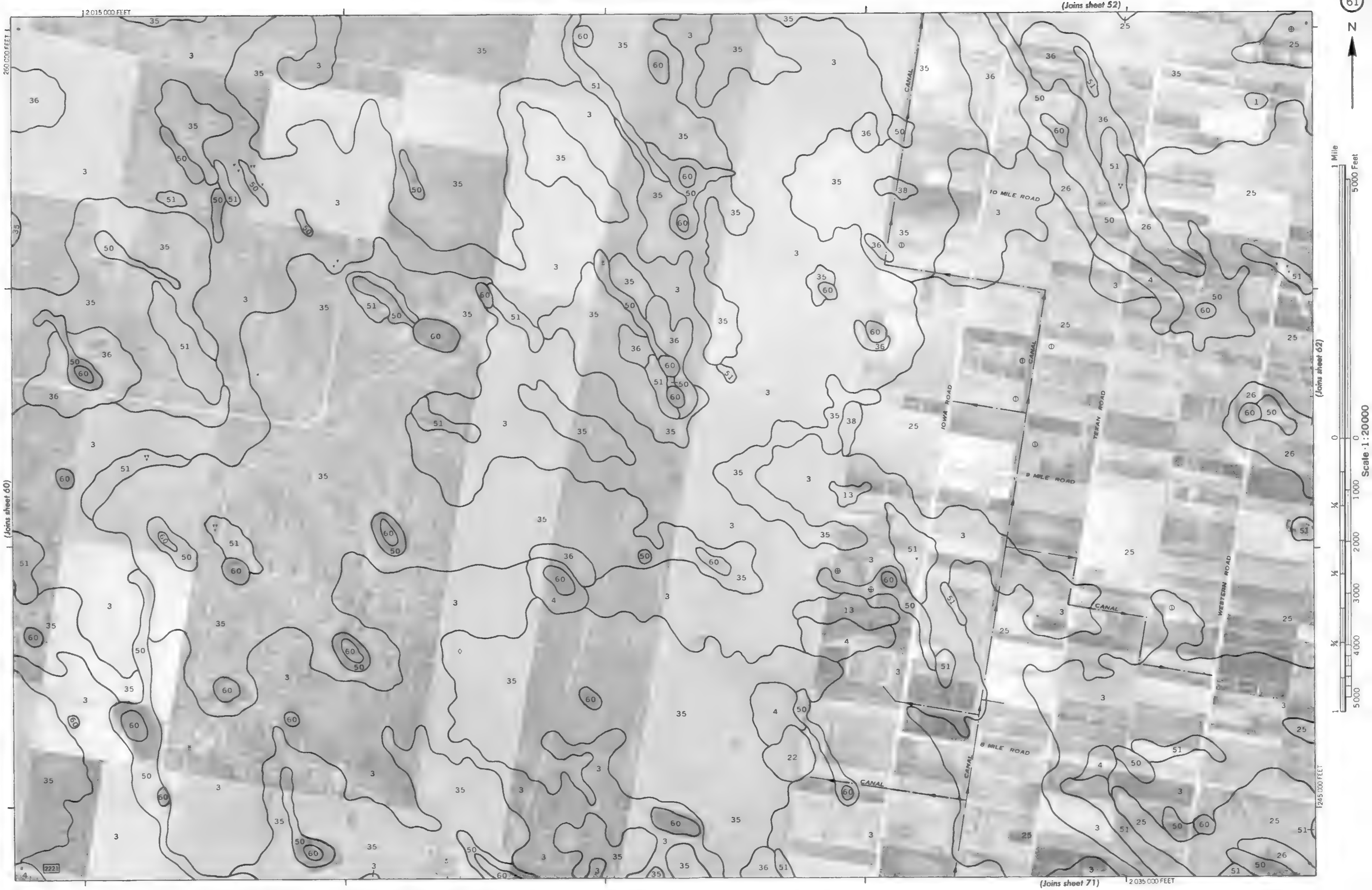
HIDALGO COUNTY, TEXAS — SHEET NUMBER 58



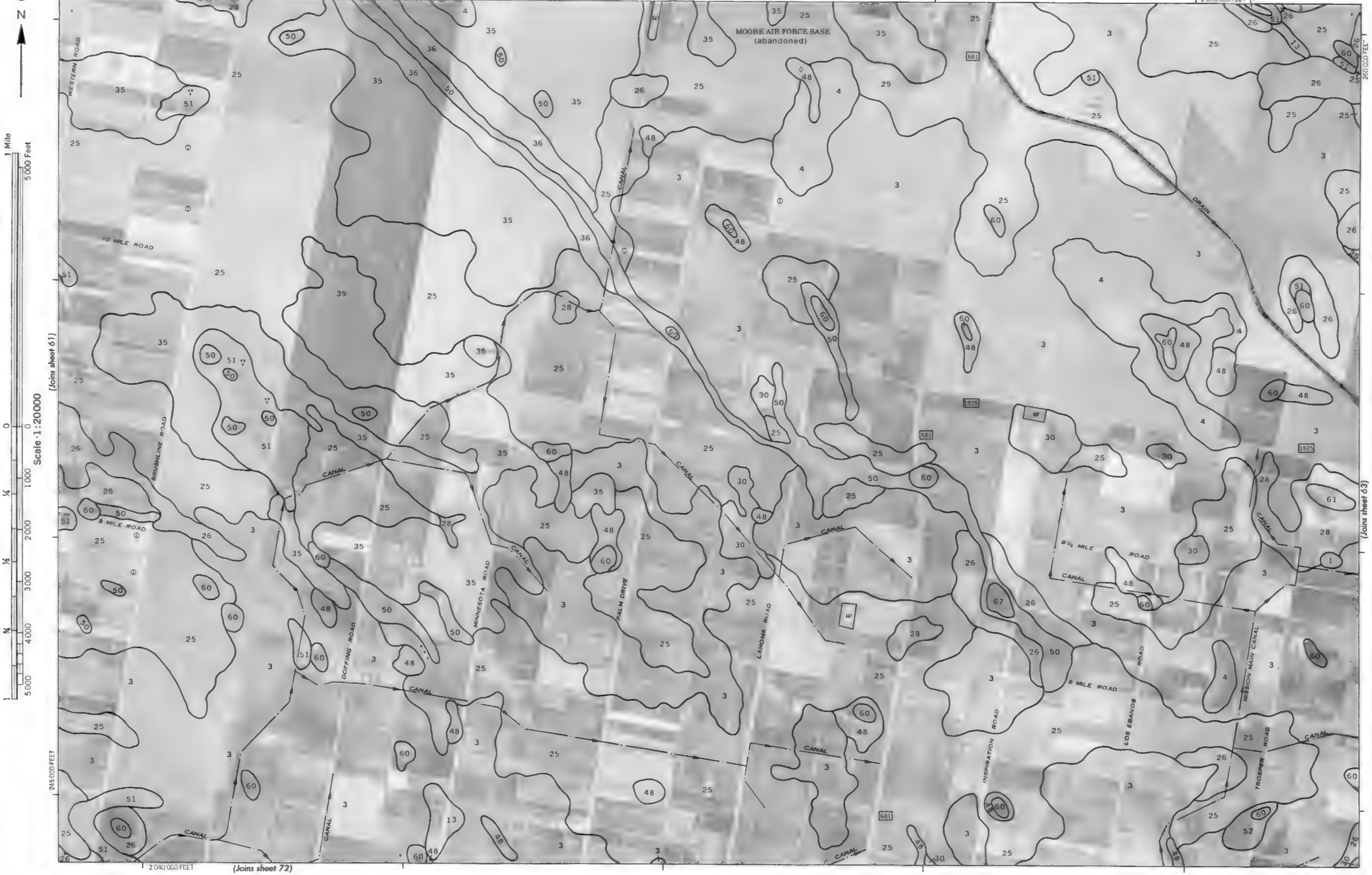
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



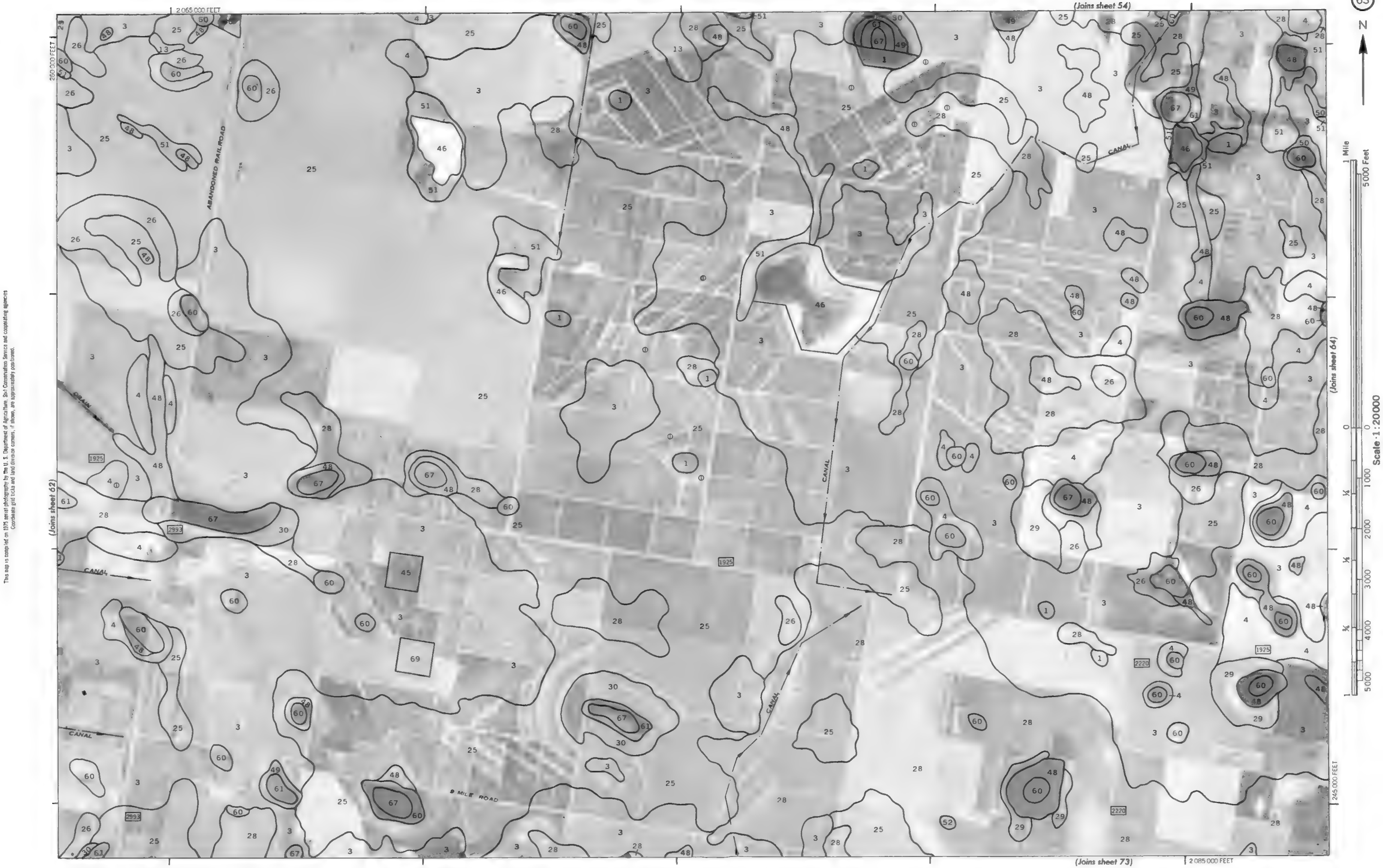
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

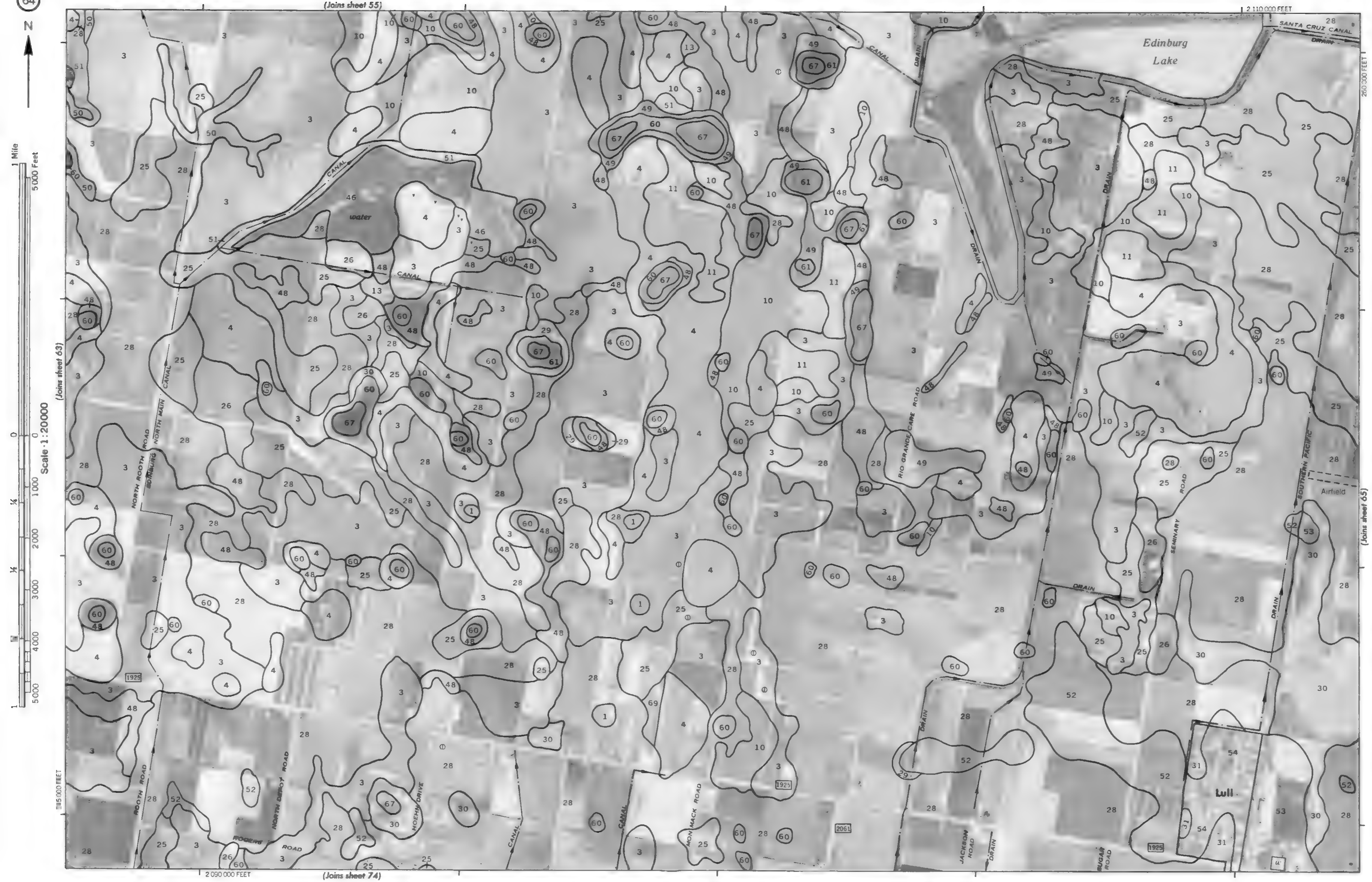

61
N
(Joins sheet 52)
(Joins sheet 62)
(Joins sheet 71)
(Joins sheet 60)
2 015 000 FEET
2 035 000 FEET
260 000 FEET
245 000 FEET
10 MILE ROAD
9 MILE ROAD
8 MILE ROAD
IOWA ROAD
TEXAN ROAD
WESTERN ROAD
CANAL
Scale 1:20000
1 Mile
5000 Feet

HIDALGO COUNTY, TEXAS — SHEET NUMBER 62

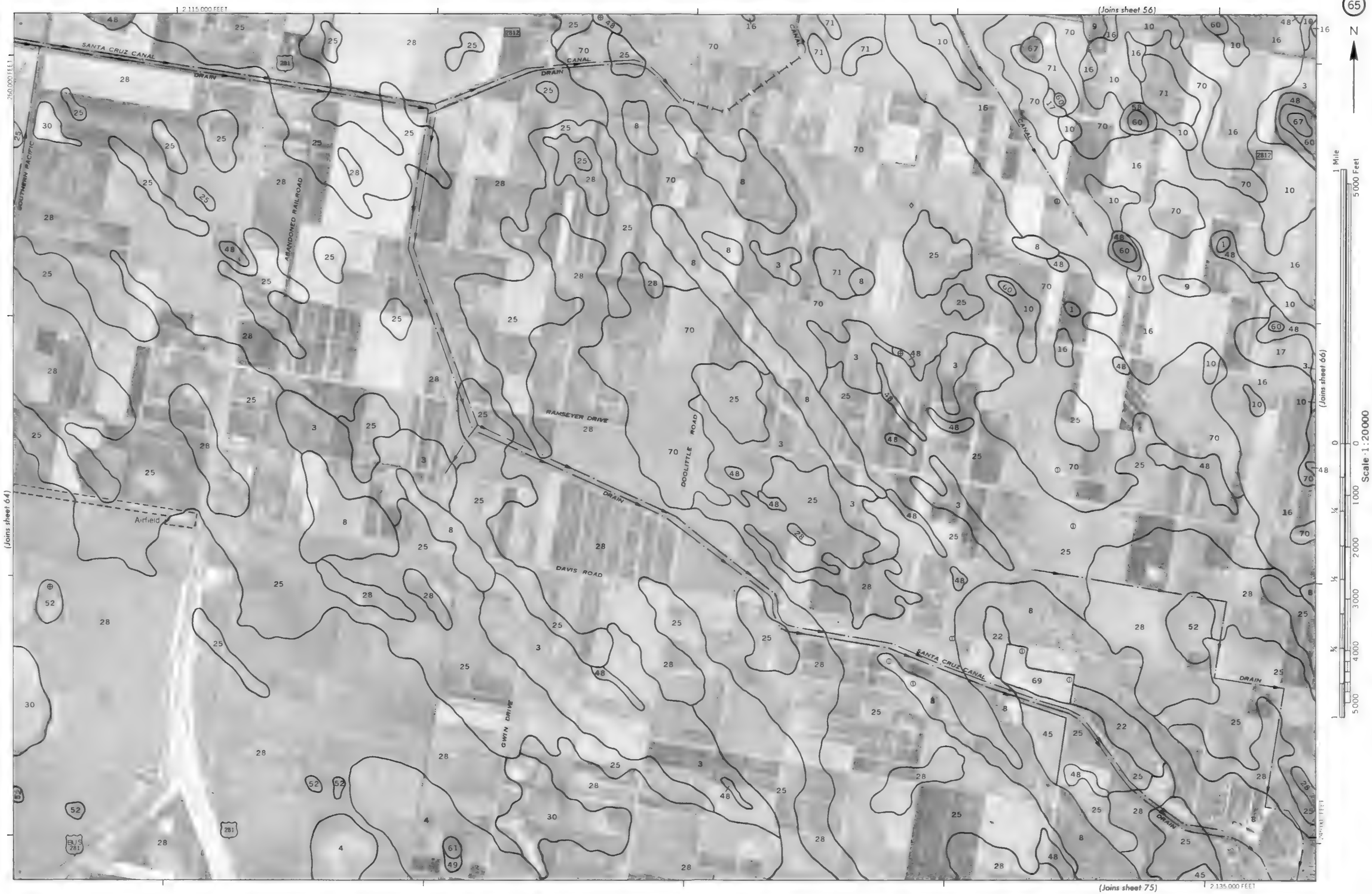


This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


63
N
(Joins sheet 54)
(Joins sheet 62)
(Joins sheet 64)
(Joins sheet 73)
2 065 000 FEET
2 085 000 FEET
250 000 FEET
245 000 FEET
ABANDONED RAILROAD
DRAIN
CANAL
8 MILE ROAD
1925
2993
2220
1 Mile
5000 Feet
Scale 1:20000
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

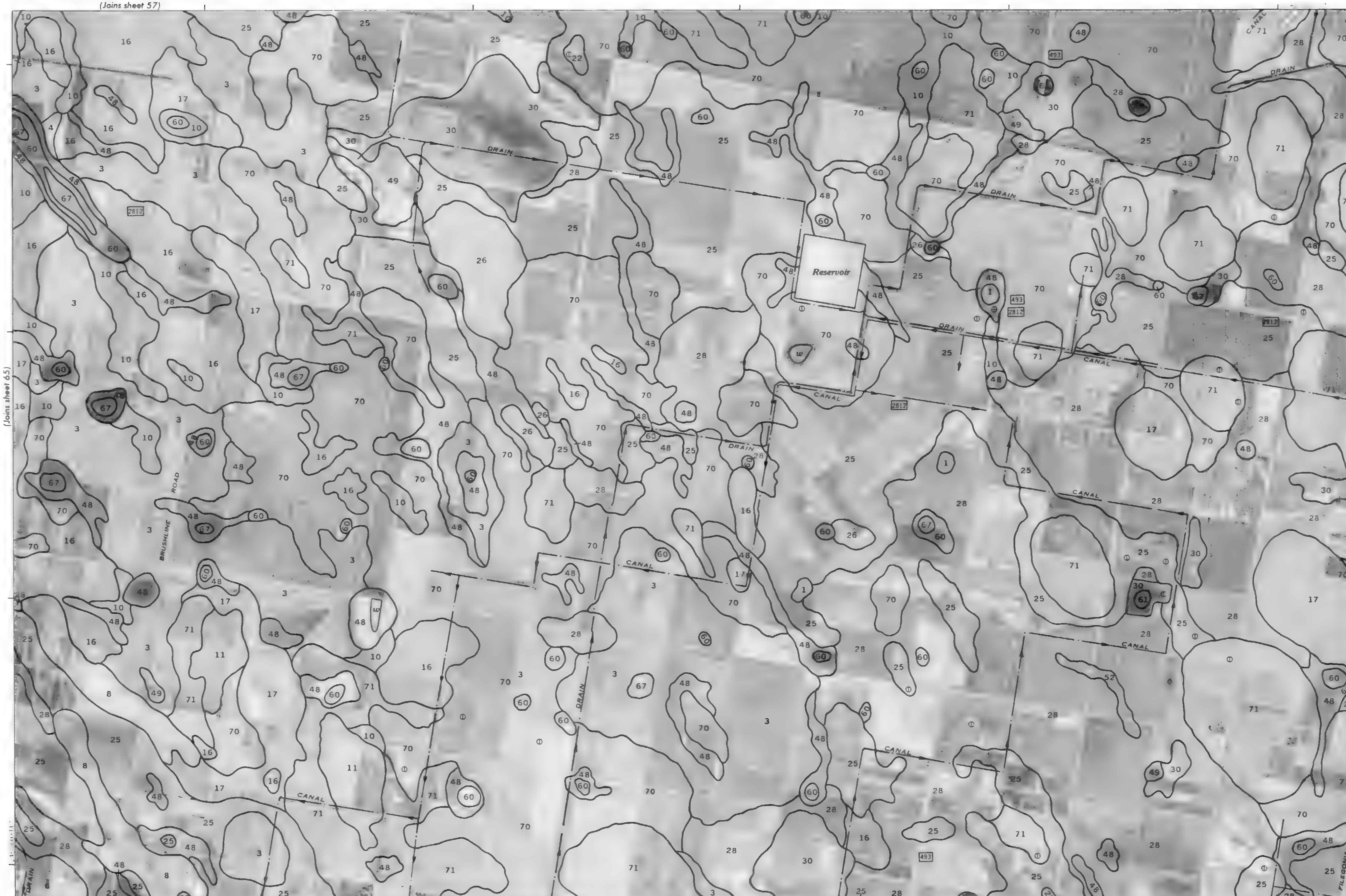


This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

66

N

(Joins sheet 57)



(Joins sheet 65)

(Joins sheet 67)

(Joins sheet 76)

1 Mile

5000 Feet

Scale 1:20000

0

1000

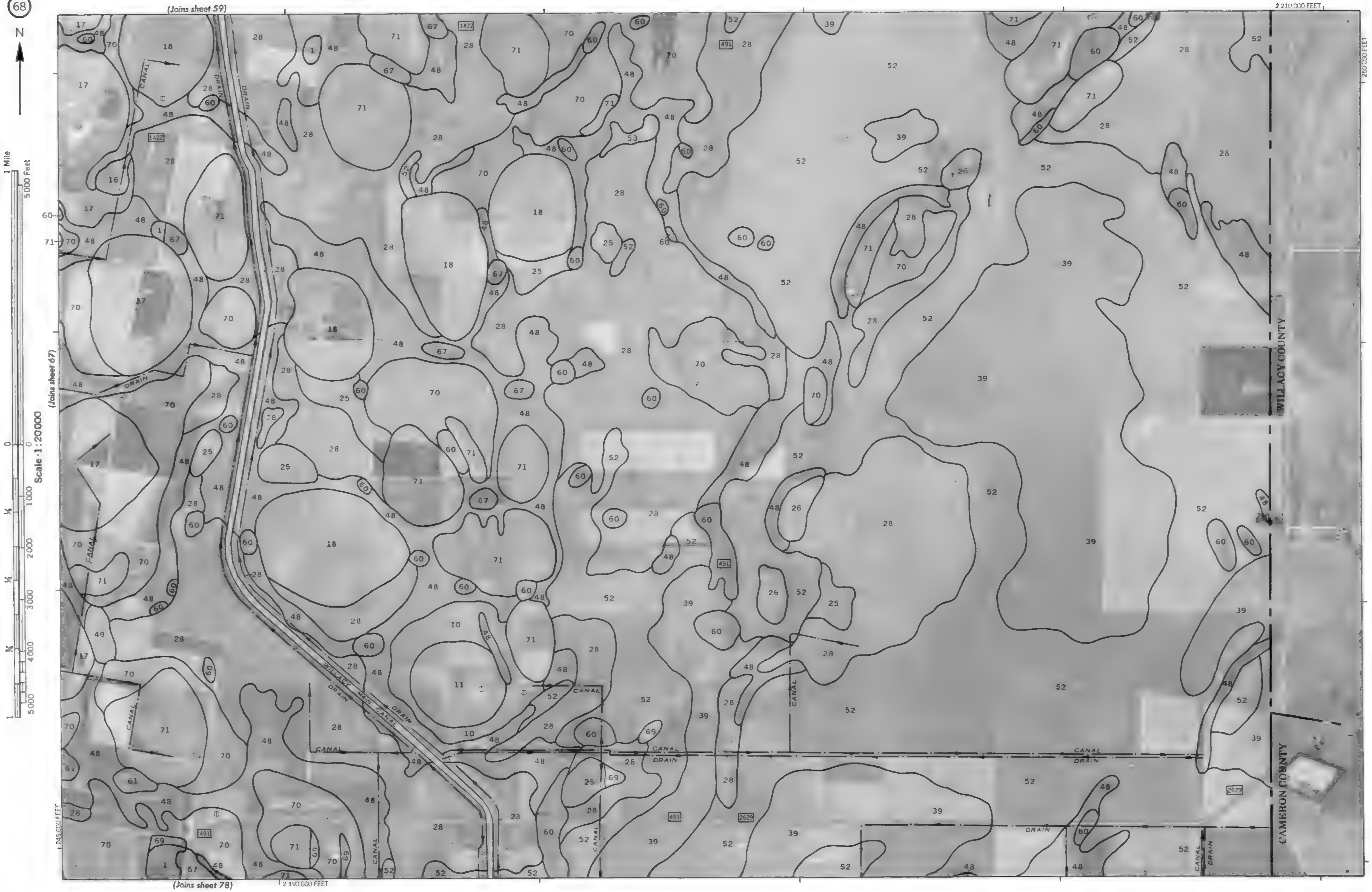
2000

3000

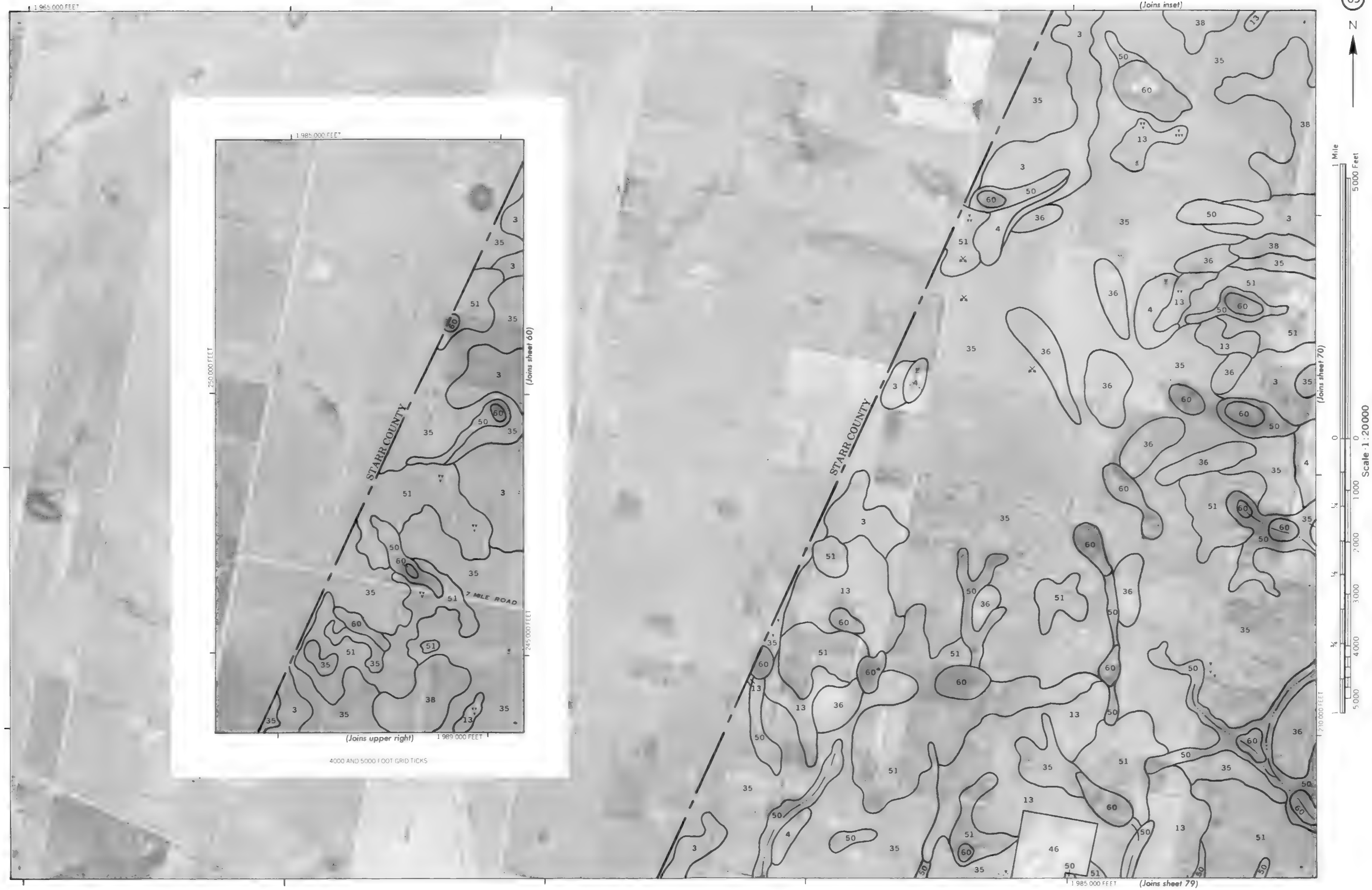
4000

5000


(Joins sheet 58)
(Joins sheet 66)
(Joins sheet 68)
(Joins sheet 77)
Monte Alto
ABANDONED RAILROAD
DONNA DRAIN
CANAL
DRAIN
N
1 Mile
5000 Feet
Scale 1:20000

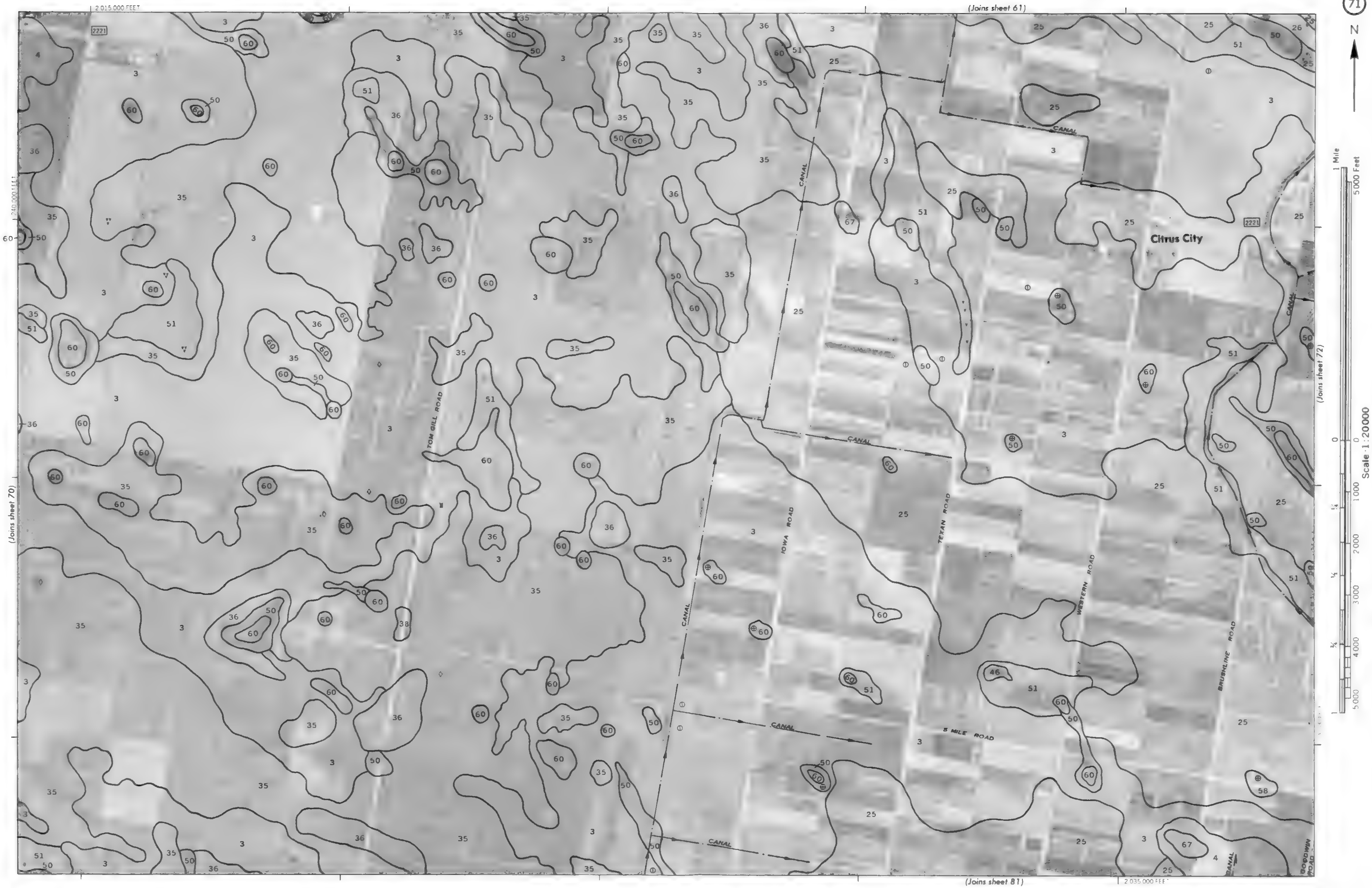


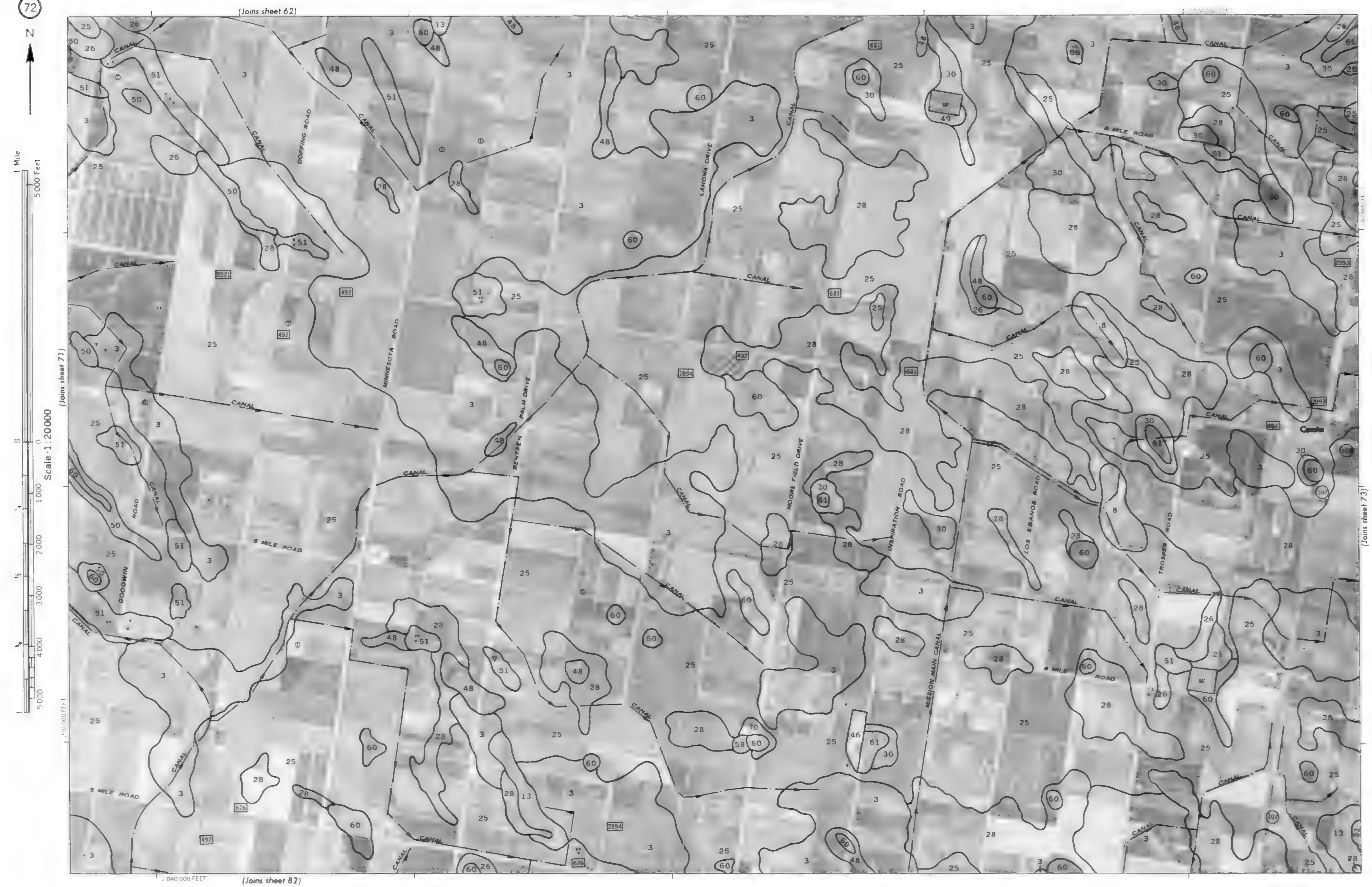
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



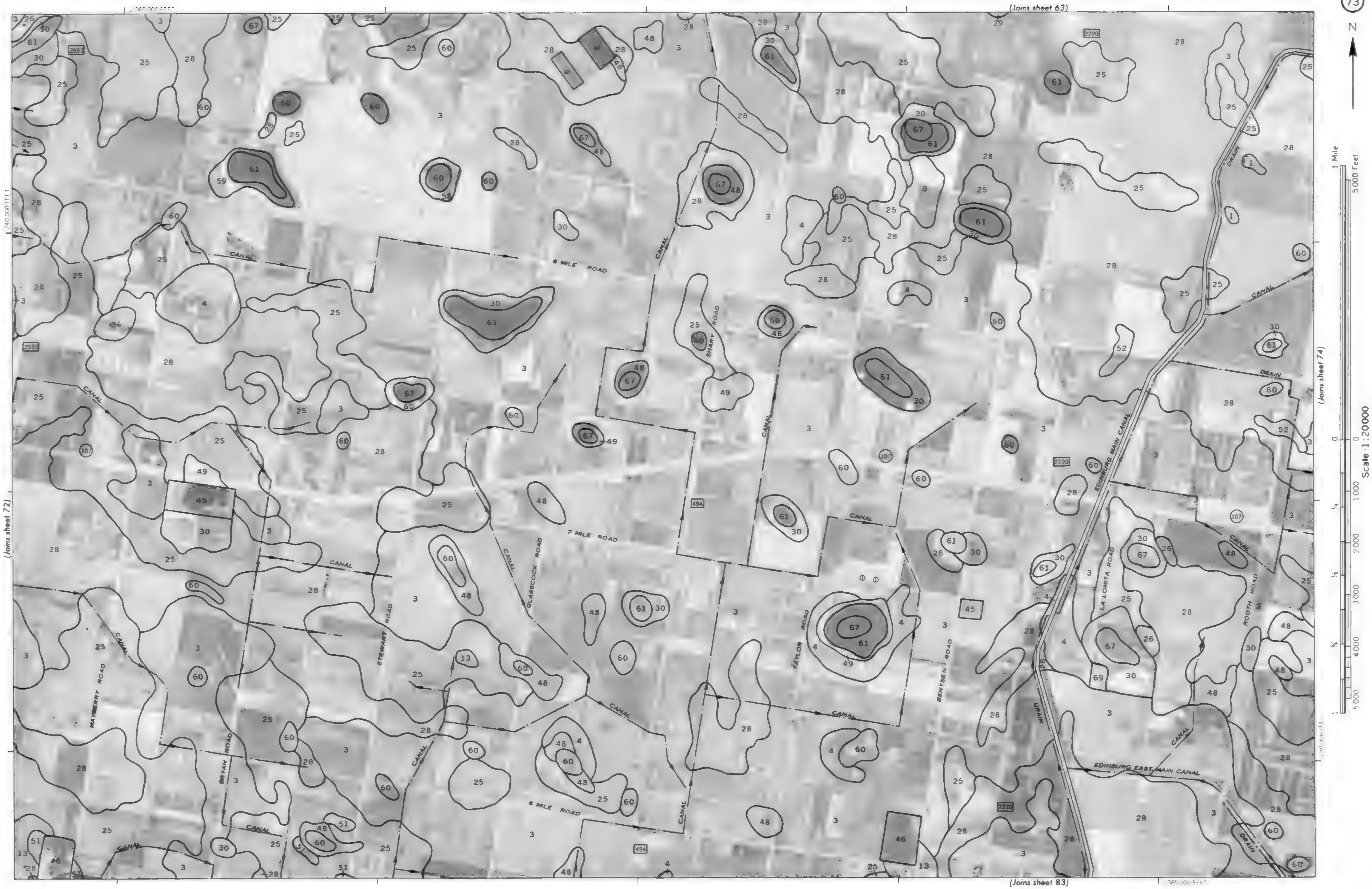
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 60)
(Joins sheet 69)
(Joins sheet 71)
(Joins sheet 80)
La Joya Creek
water


(Joins sheet 61)
(Joins sheet 81)
(Joins sheet 70)
(Joins sheet 72)
2 015 000 FEET
2 035 000 FEET
240 000 FEET
2221
Citrus City
TOM GILL ROAD
IOWA ROAD
TEXAN ROAD
WESTERN ROAD
BRUSHLINE ROAD
5 MILE ROAD
GOODWIN ROAD
CANAL
N
1 Mile
5000 Feet
Scale 1:20000

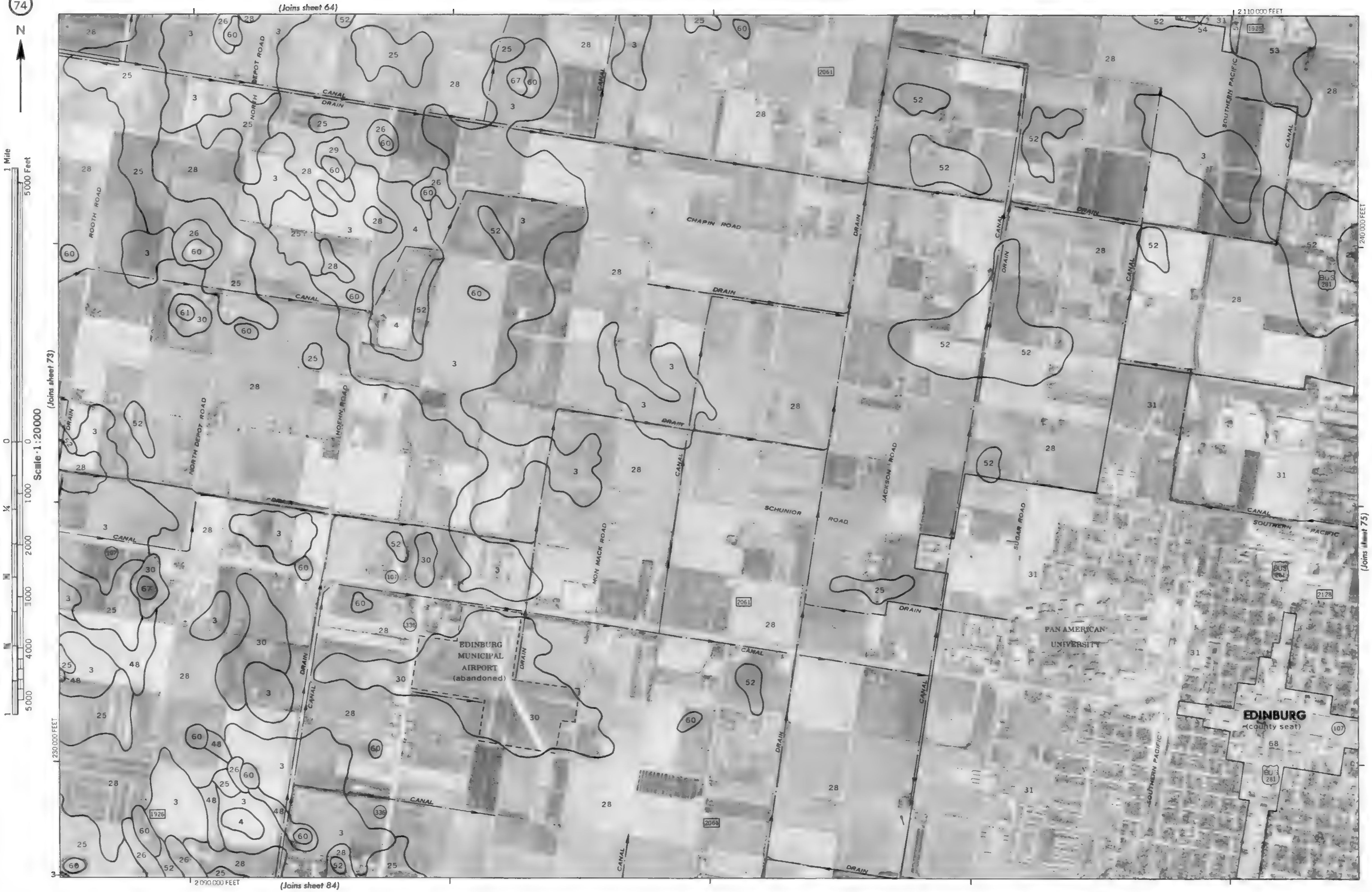

72
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
(Joins sheet 62)
(Joins sheet 71)
(Joins sheet 73)
(Joins sheet 82)
2 040 000 FEET
DOFFING ROAD
LAHOMA DRIVE
MINNESOTA ROAD
BENTSEN PALM DRIVE
MOORE FIELD DRIVE
INSPIRATION ROAD
MISSION MAIN CANAL
LOS EBANOS ROAD
TROSPER ROAD
GOODWIN ROAD
6 MILE ROAD
5 MILE ROAD
8 MILE ROAD
CANAL
Cuevitas
2221
492
2894
681
2993
676
107

73



HIDALGO COUNTY, TEXAS NO. 73

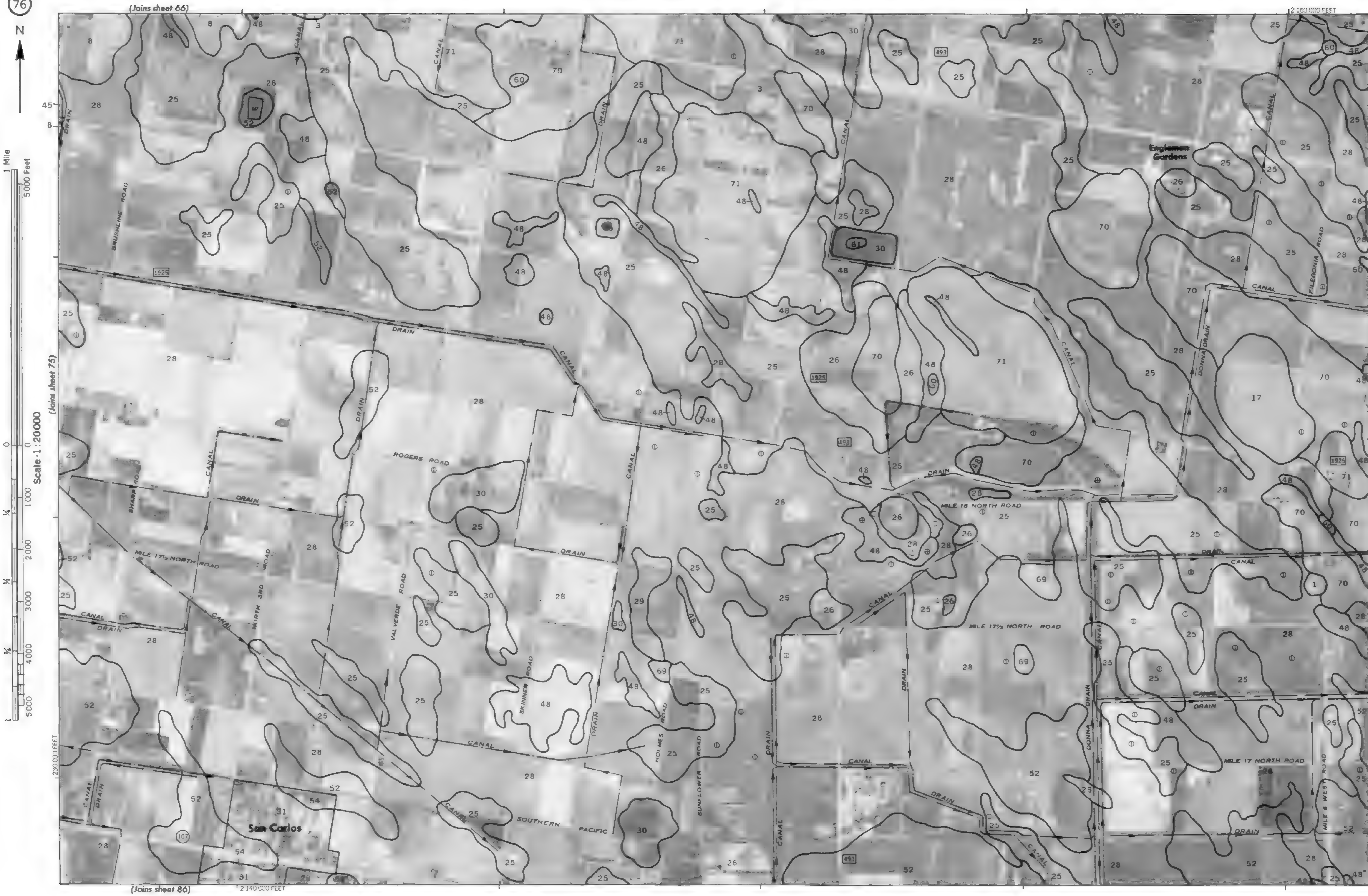
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HIDALGO COUNTY, TEXAS — SHEET NUMBER 75

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

77

N

Scale 1:20000

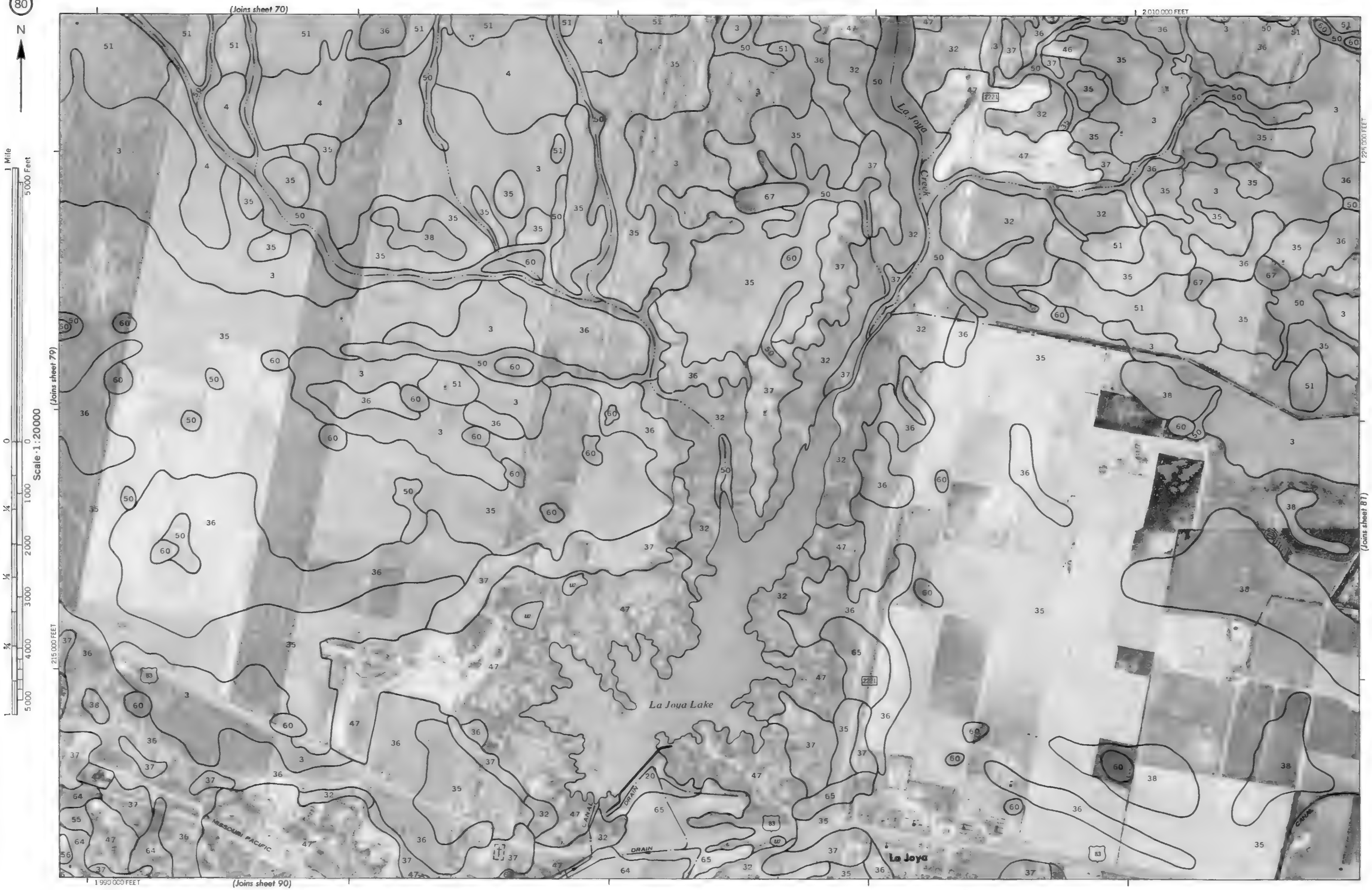
1 Mile
5000 Feet

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

78

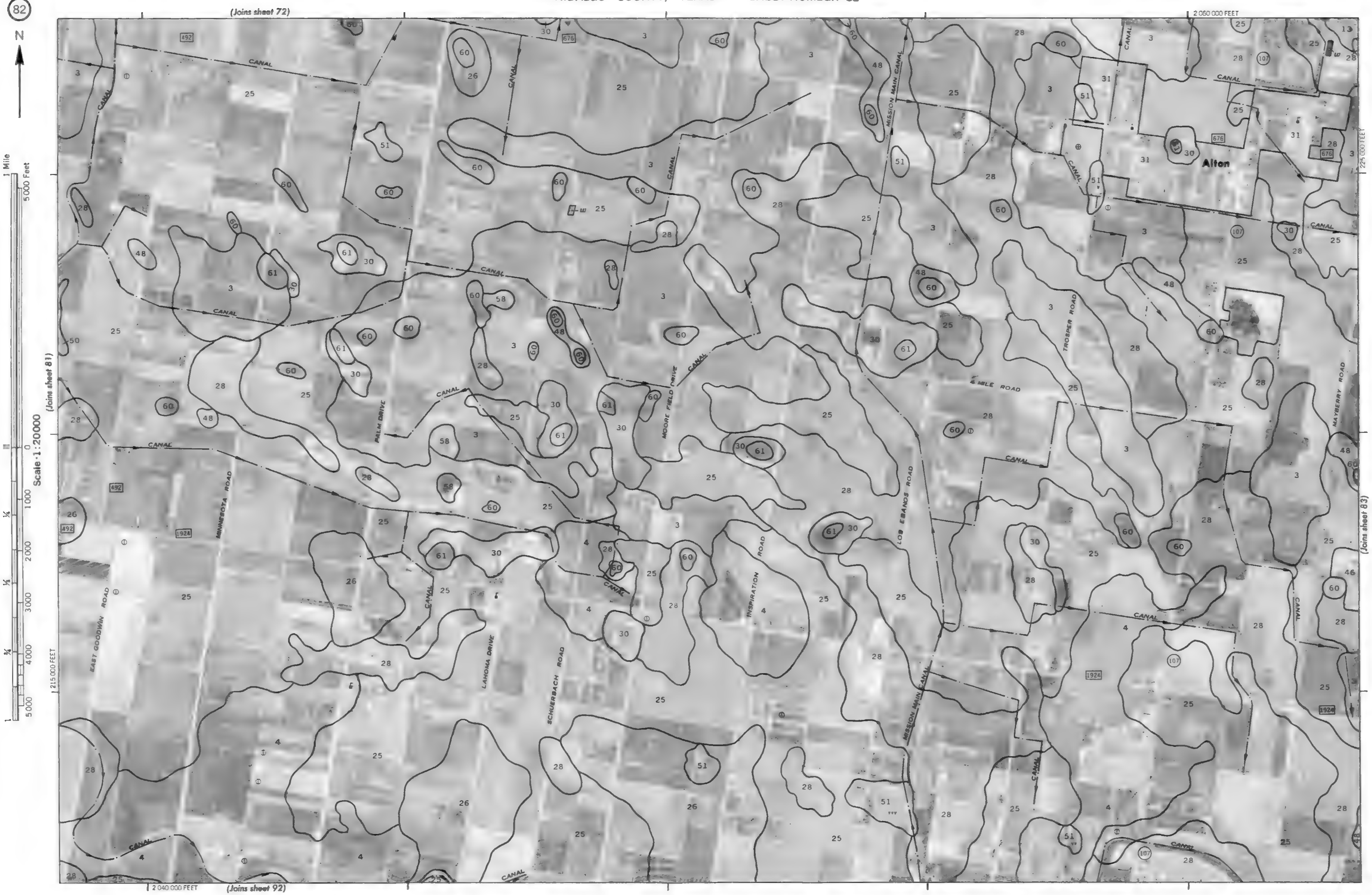
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

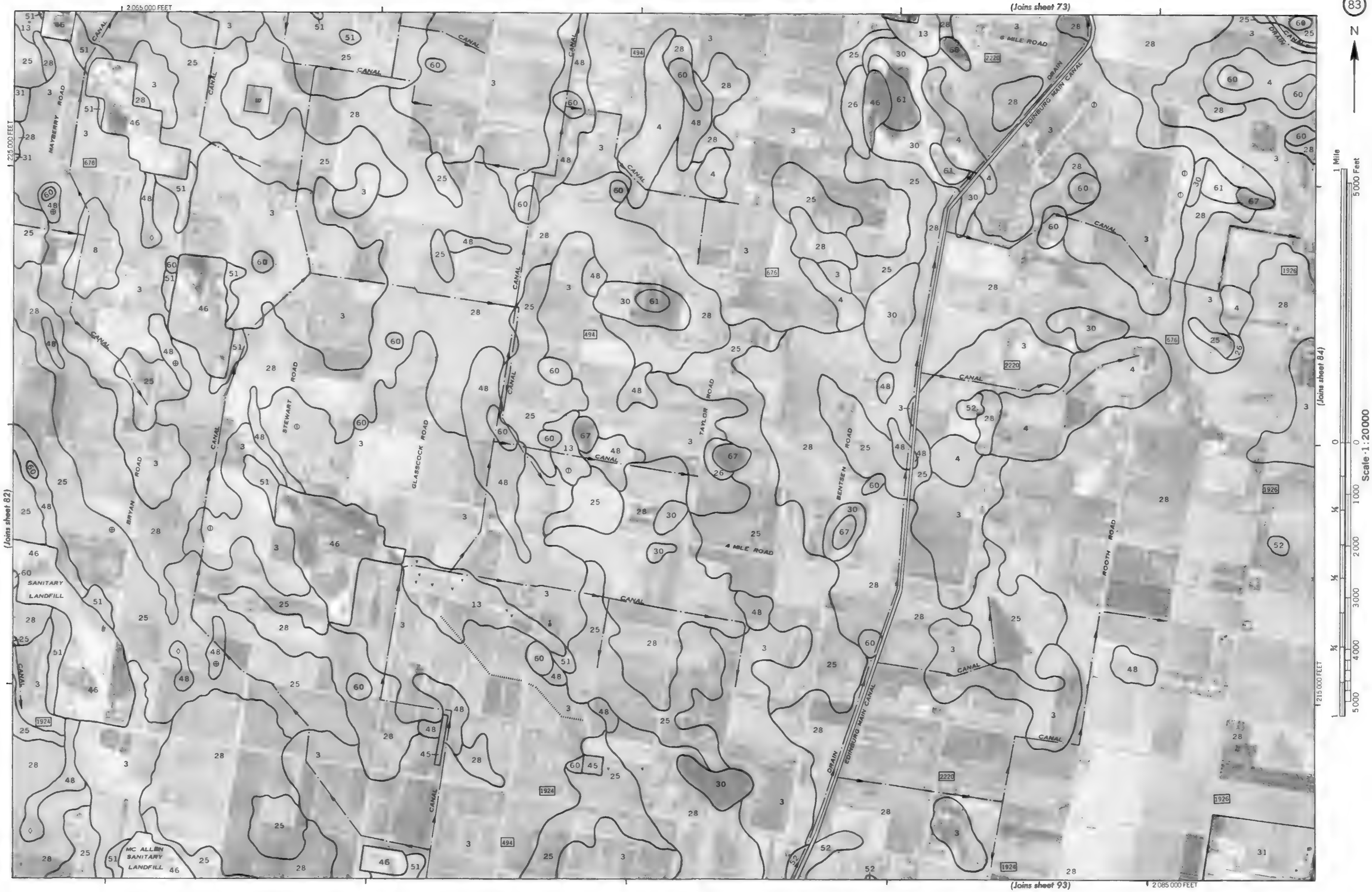


This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


81
N
(Joins sheet 71)
(Joins sheet 80)
(Joins sheet 82)
(Joins sheet 91)
2 015 000 FEET
2 035 000 FEET
CANAL
4 MILE ROAD
3 MILE ROAD
TEXAN ROAD
WESTERN ROAD
BRUSHLINE ROAD
GOODWIN ROAD
IOWA ROAD
TOM GILL ROAD
EAST GOODWIN ROAD
Reservoir
492
1 Mile
5000 Feet
Scale 1:20000



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



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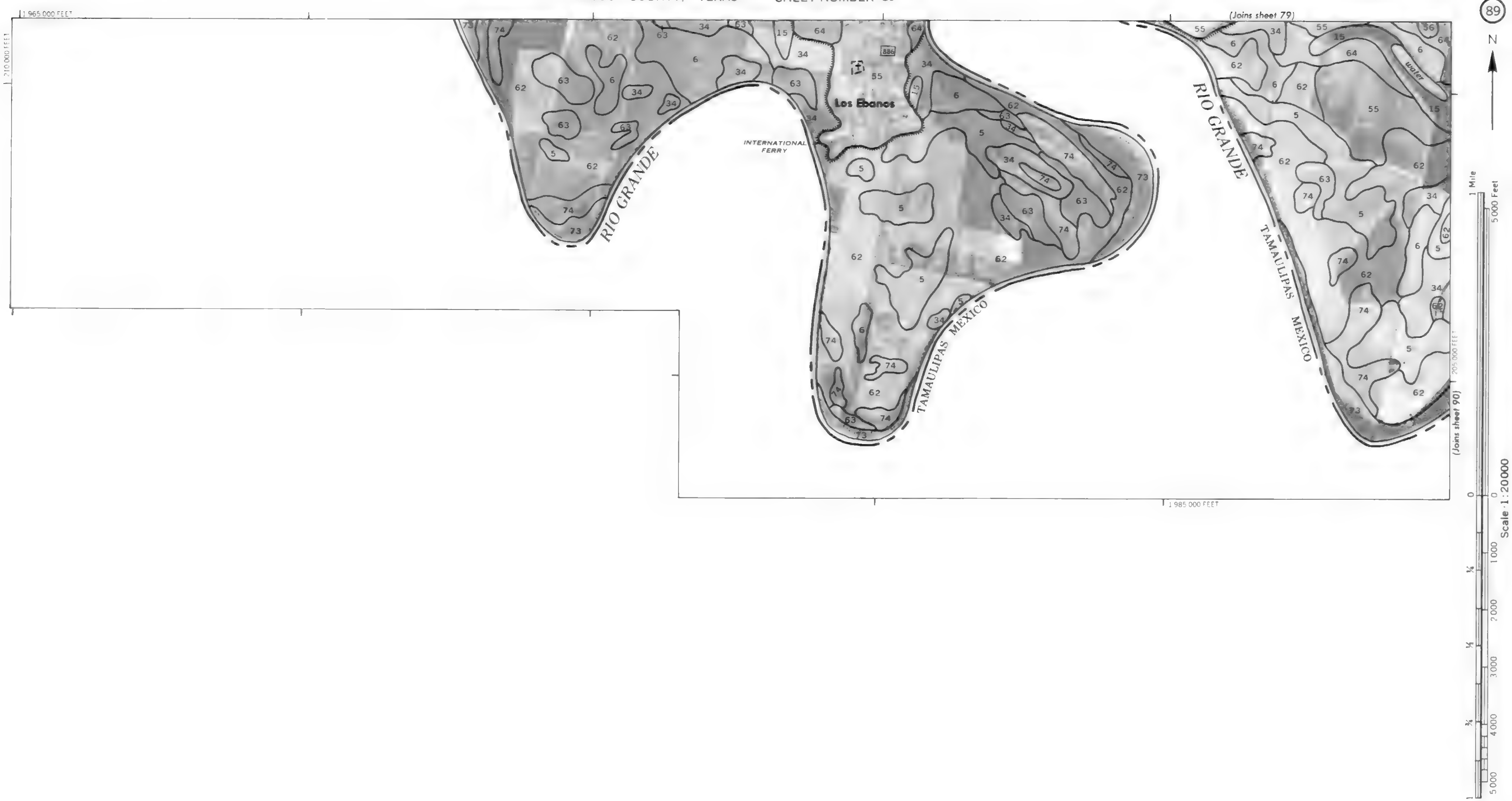

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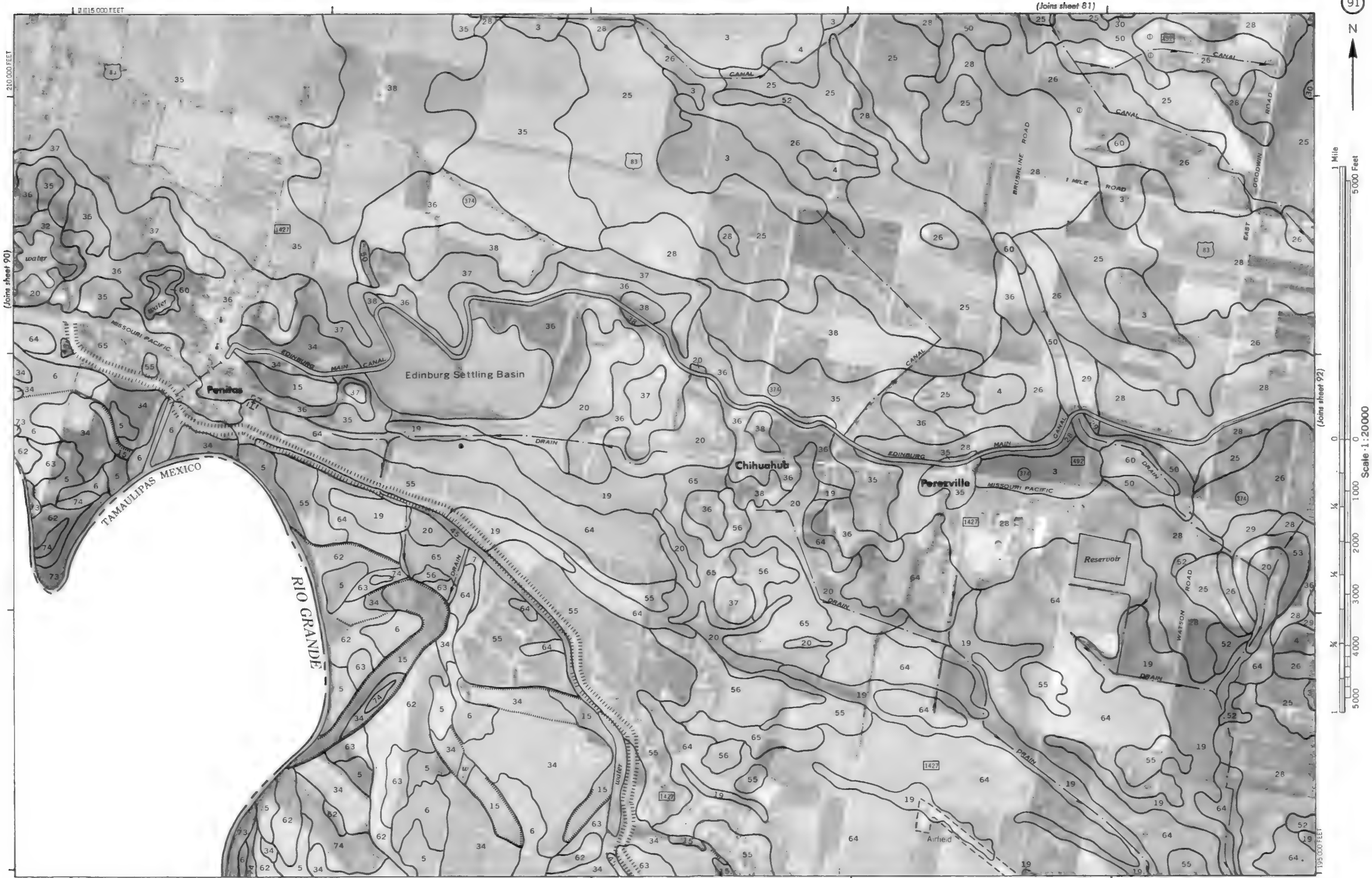

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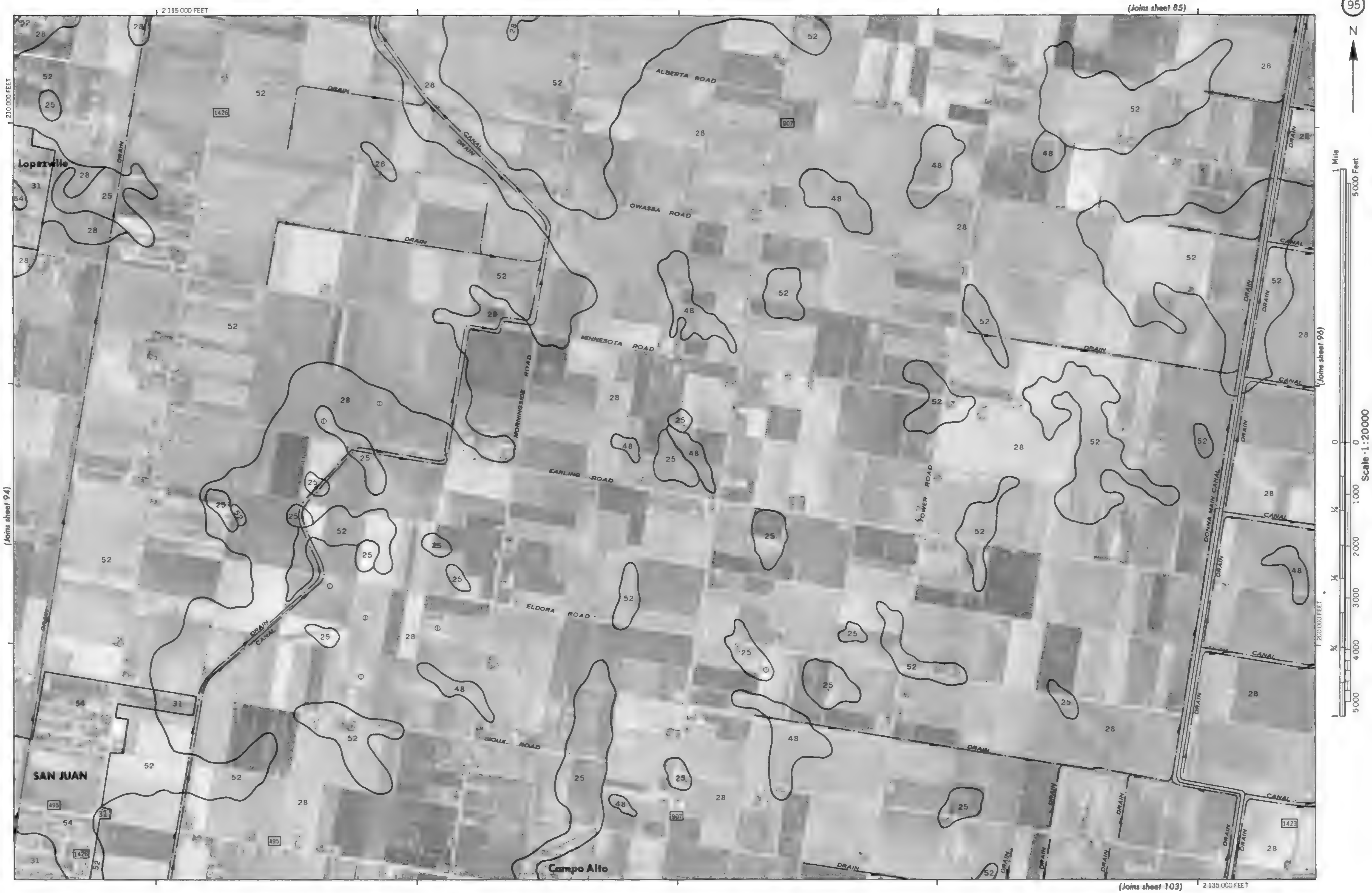

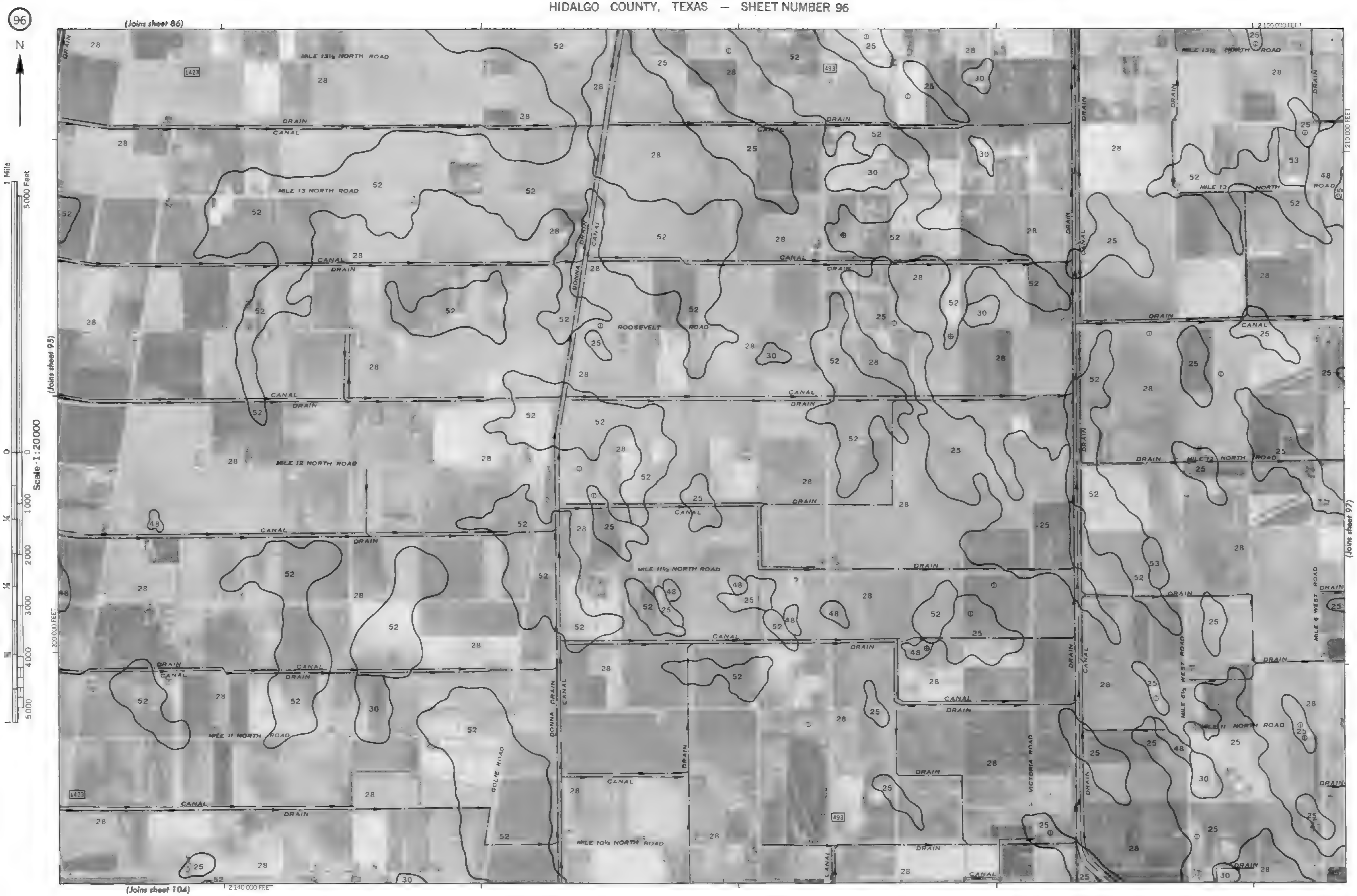

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N

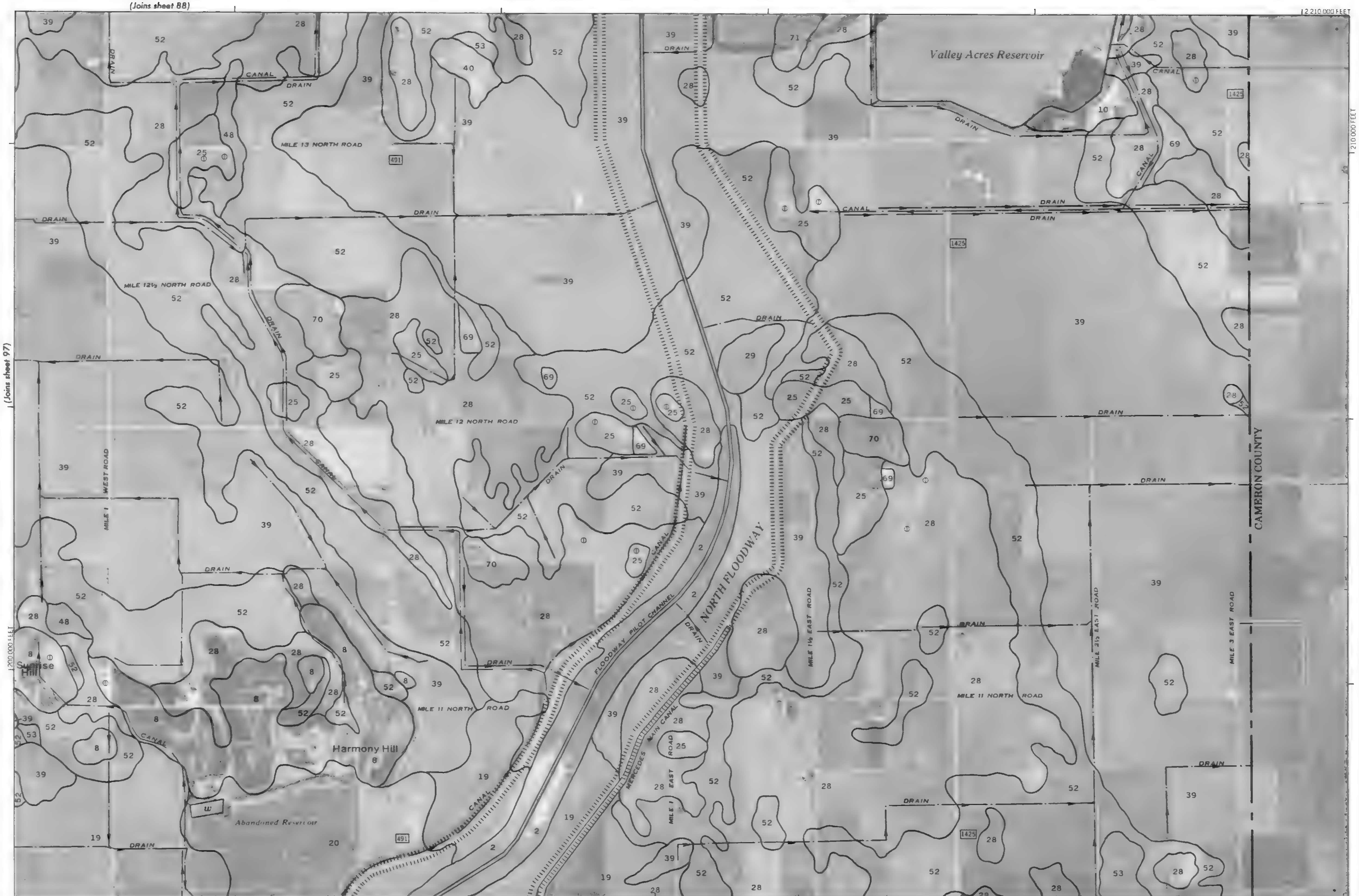
1 Mile

5000 Feet

Scale 1:20000

(Joins sheet 88)

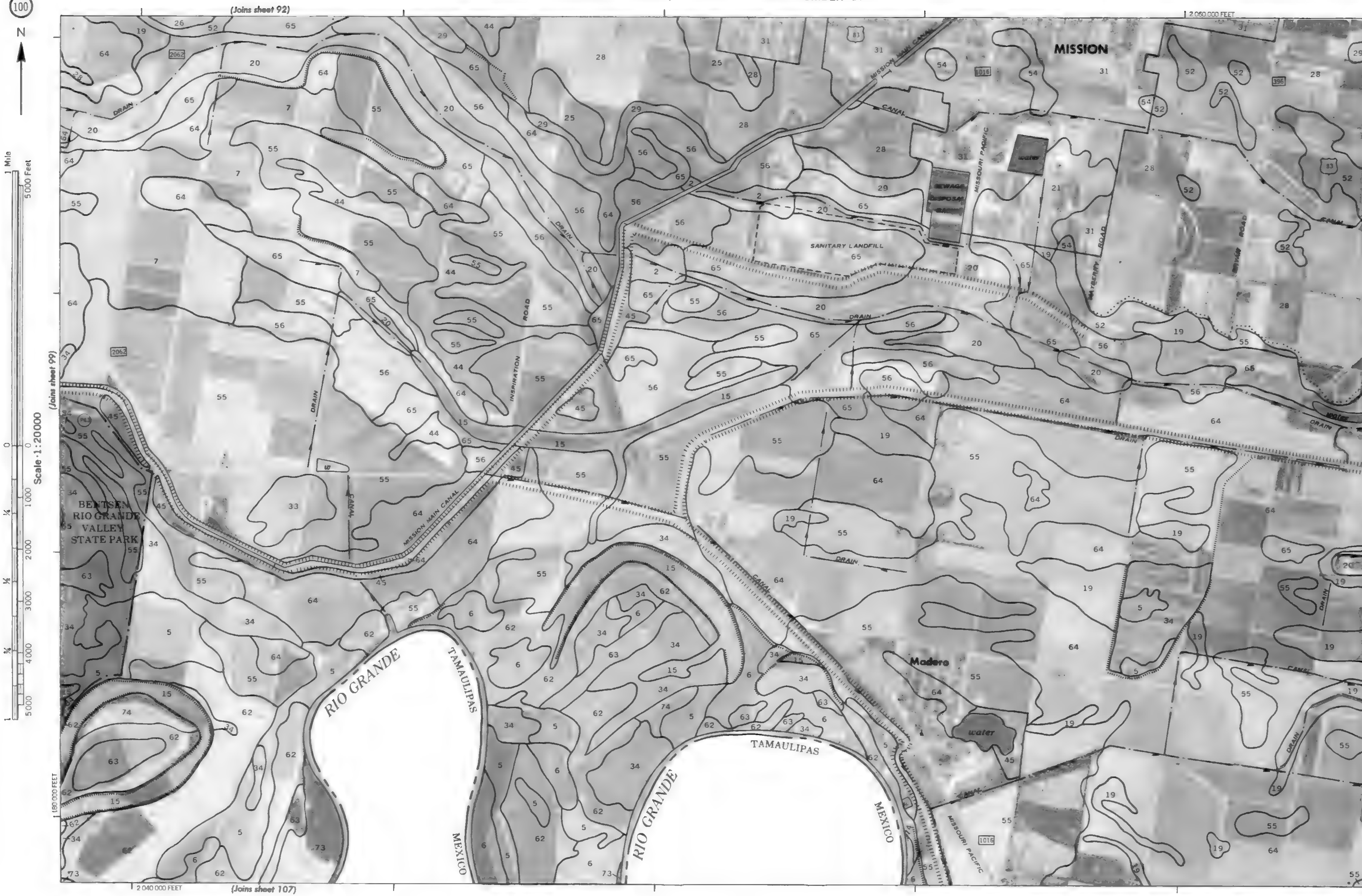
(Joins sheet 97)



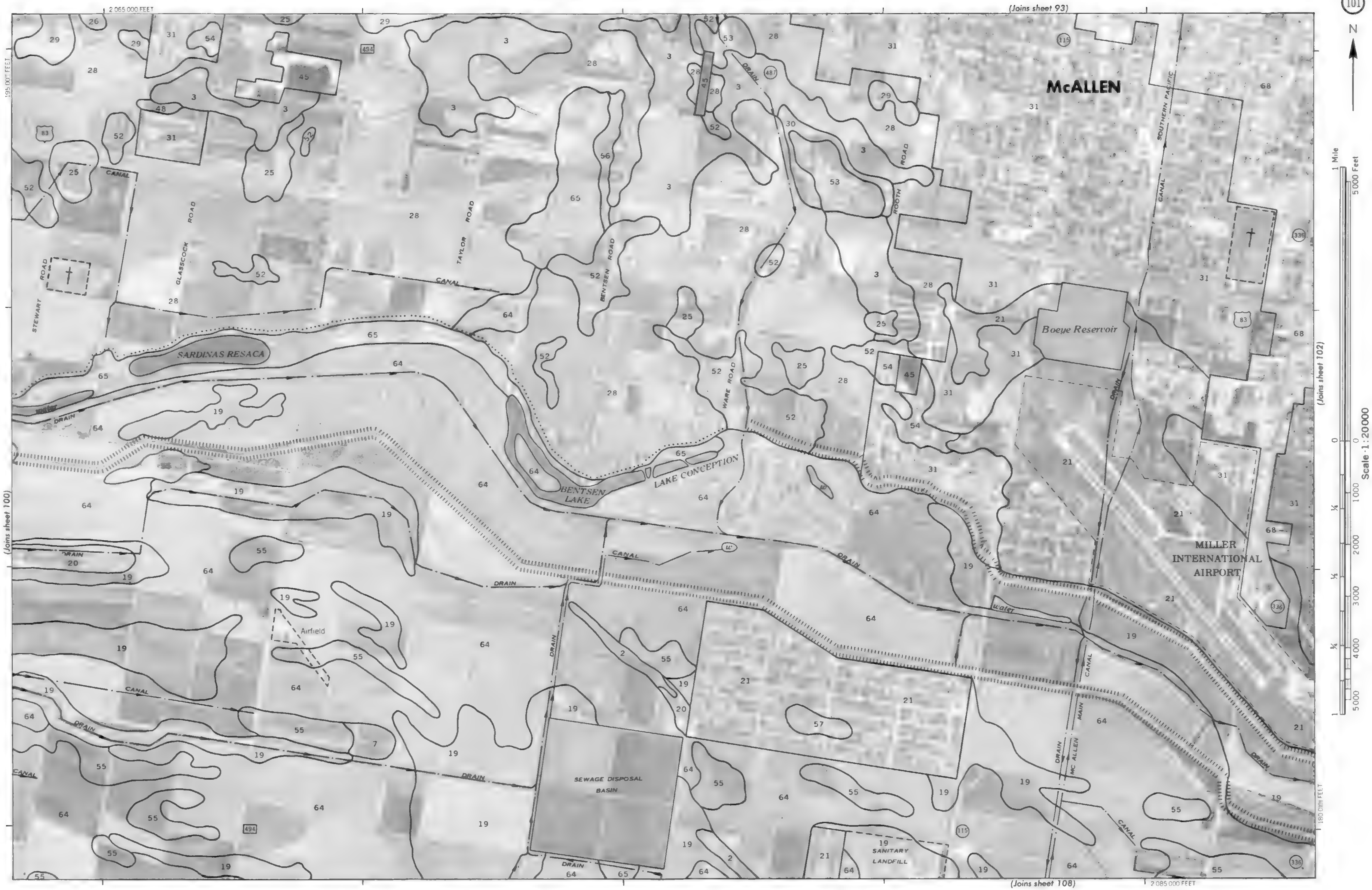
(Joins sheet 106)

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

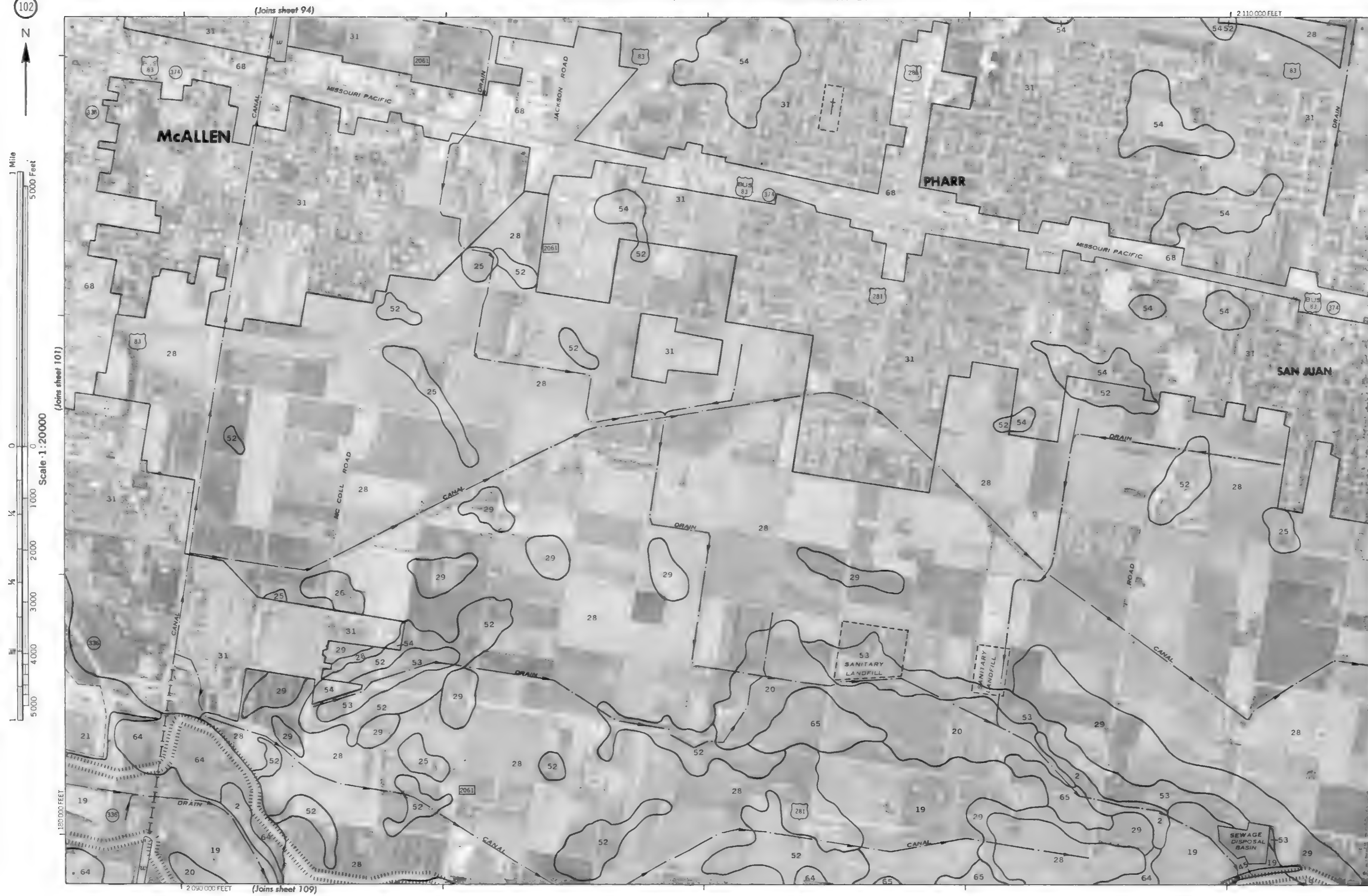

99
(Joins sheet 91)
(Joins sheet 100)
(Joins inset, sheet 107)
2 015 000 FEET
2 035 000 FEET
RIO GRANDE
TAMAULIPAS
MEXICO
Abram
Airfield
WATSON ROAD
DRAIN
BENTSEN RIO GRANDE
VALLEY STATE PARK
RIO GRANDE
N
1 Mile
5000 Feet
Scale 1:20000



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HIDALGO COUNTY, TEXAS NO. 104

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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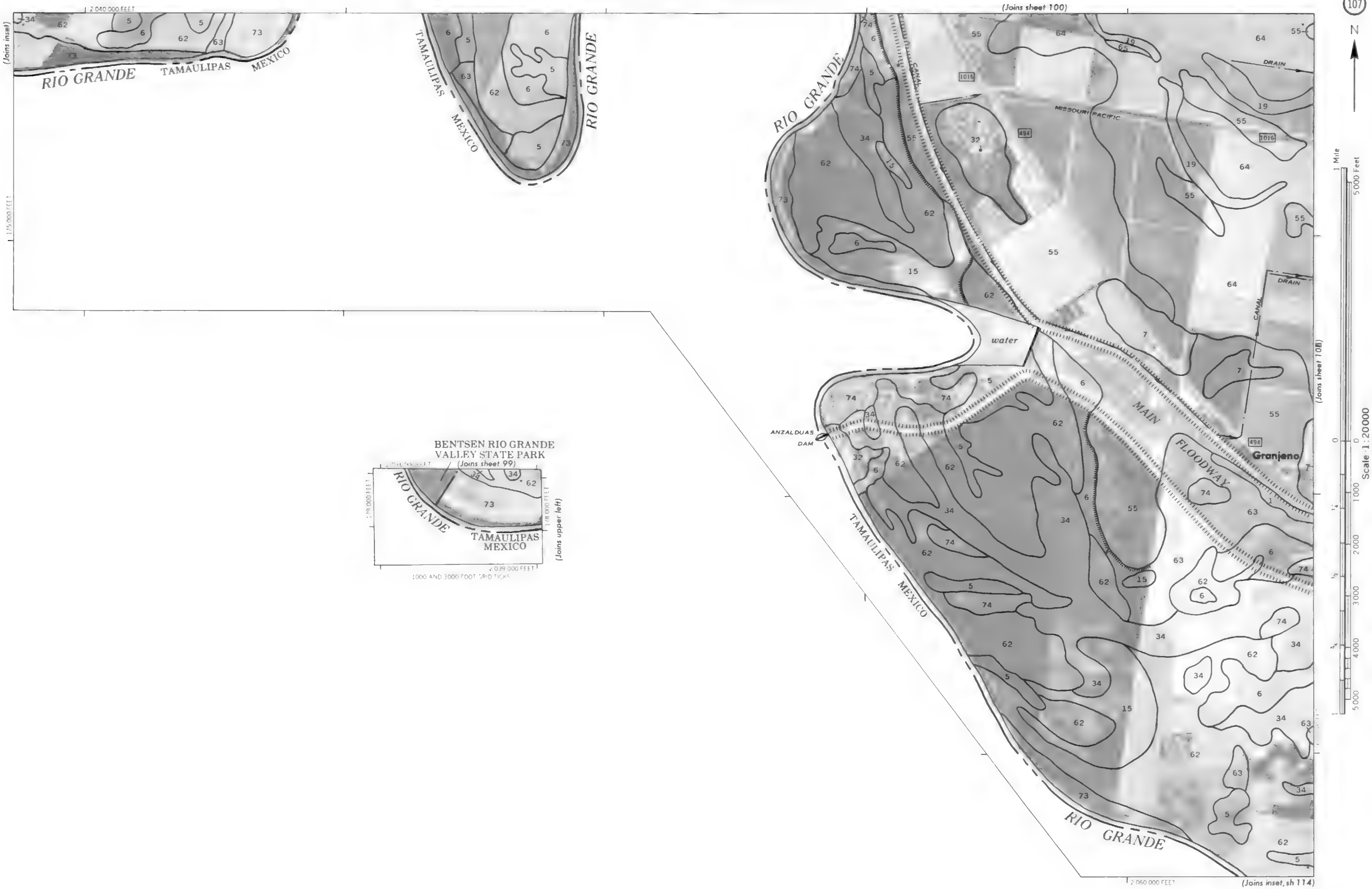
107
(Joins sheet 100)
(Joins inset)
2 040 000 FEET
RIO GRANDE
TAMAULIPAS
MEXICO
CANAL
MISSOURI PACIFIC
DRAIN
1016
494
water
ANZALDUAS DAM
MAIN FLOODWAY
Granjeno
(Joins sheet 108)
BENTSEN RIO GRANDE
VALLEY STATE PARK
(Joins sheet 99)
(Joins upper left)
1000 AND 3000 FOOT GRID TICKS
2 060 000 FEET
(Joins inset, sh 114)
N
1 Mile
5000 Feet
Scale 1:20000

HIDALGO COUNTY, TEXAS — SHEET NUMBER 108

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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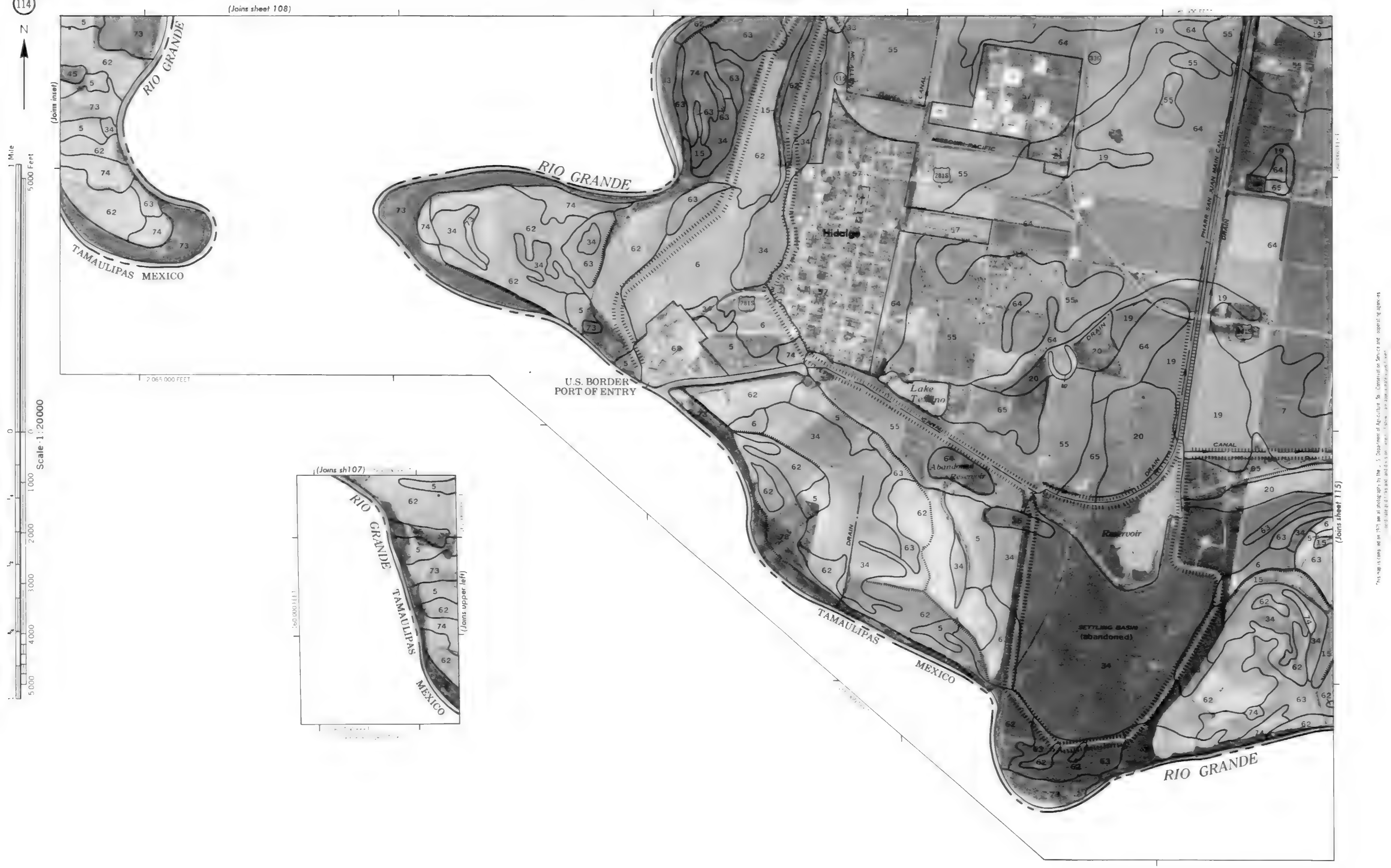
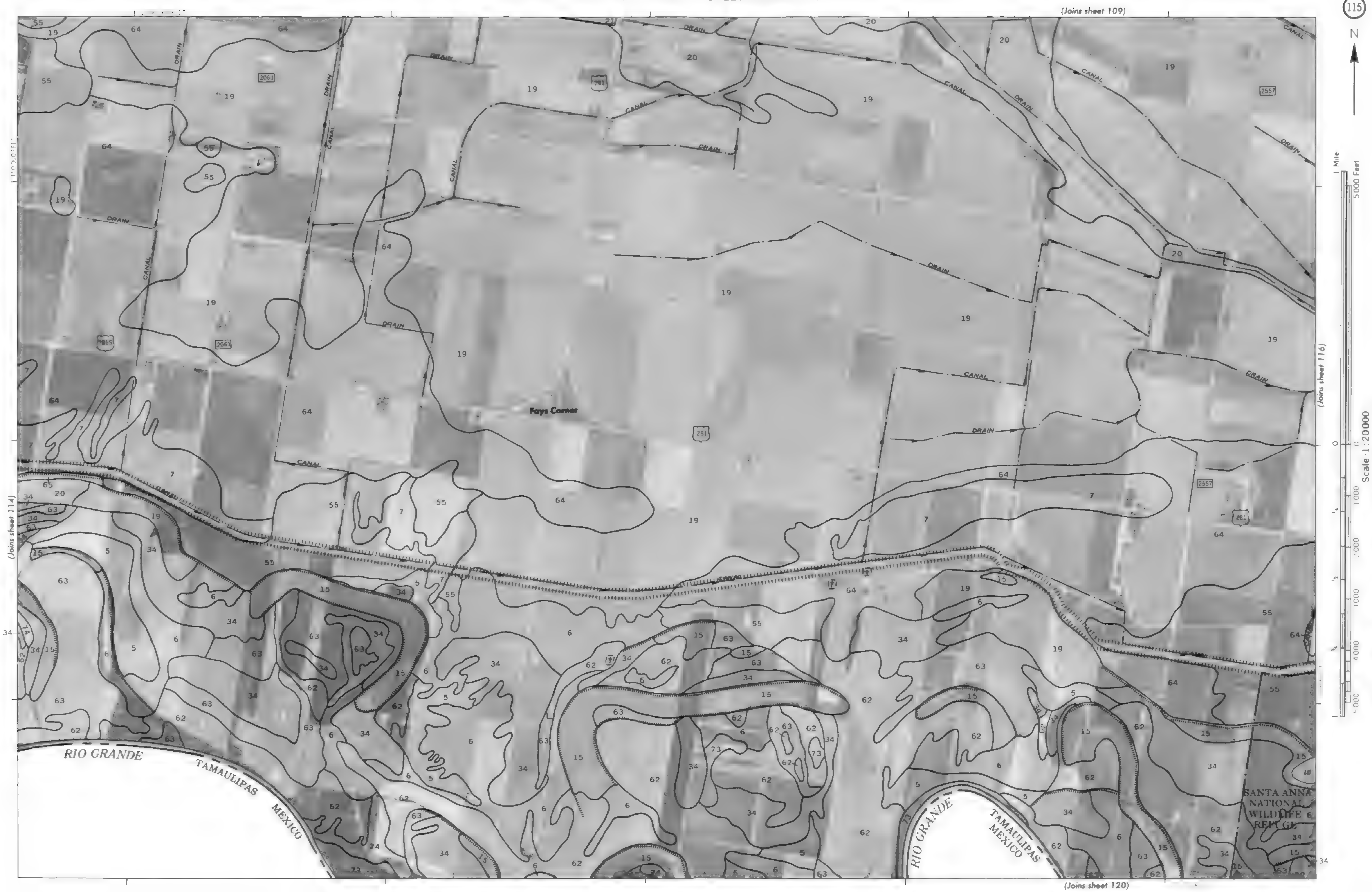
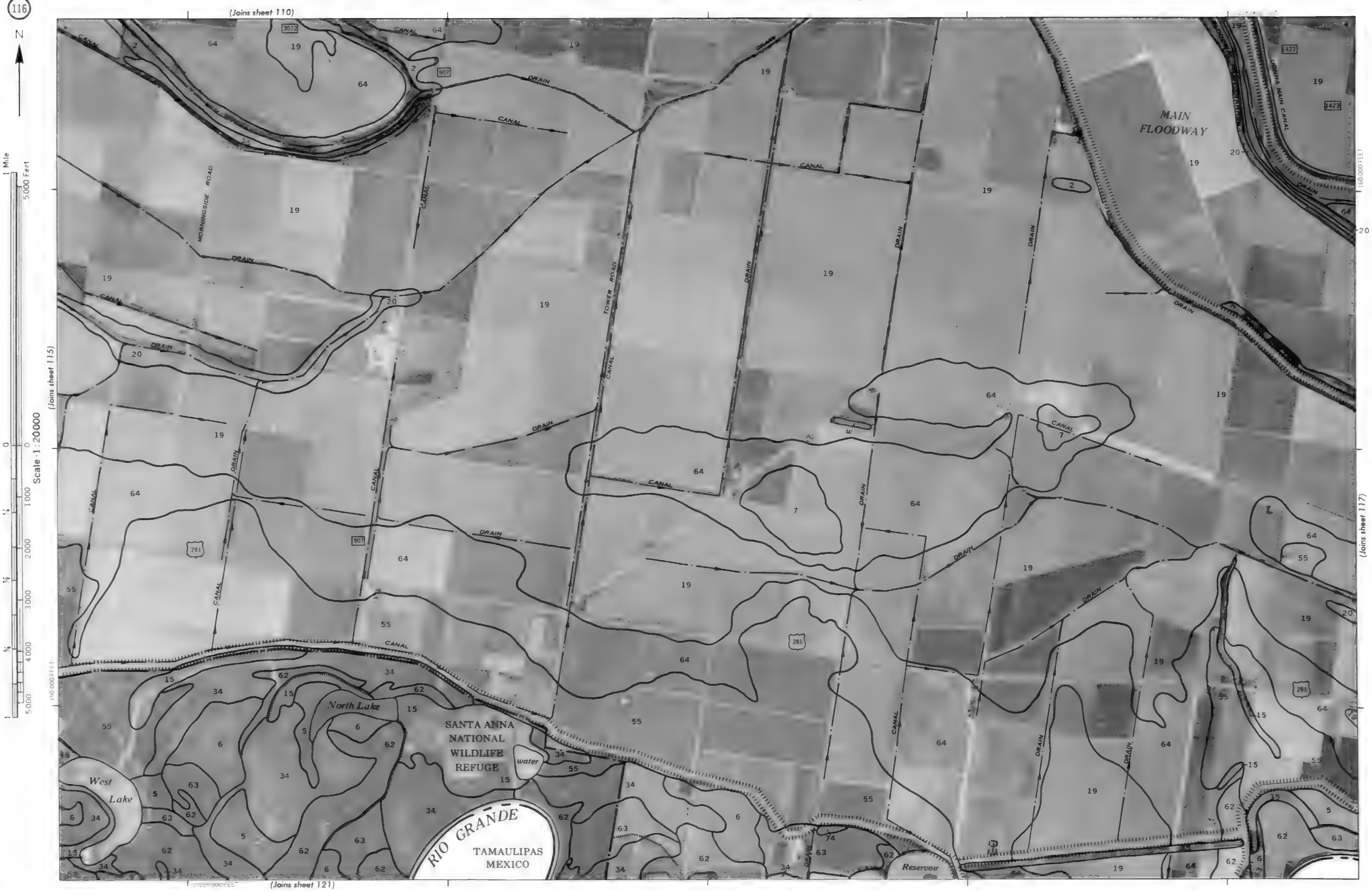
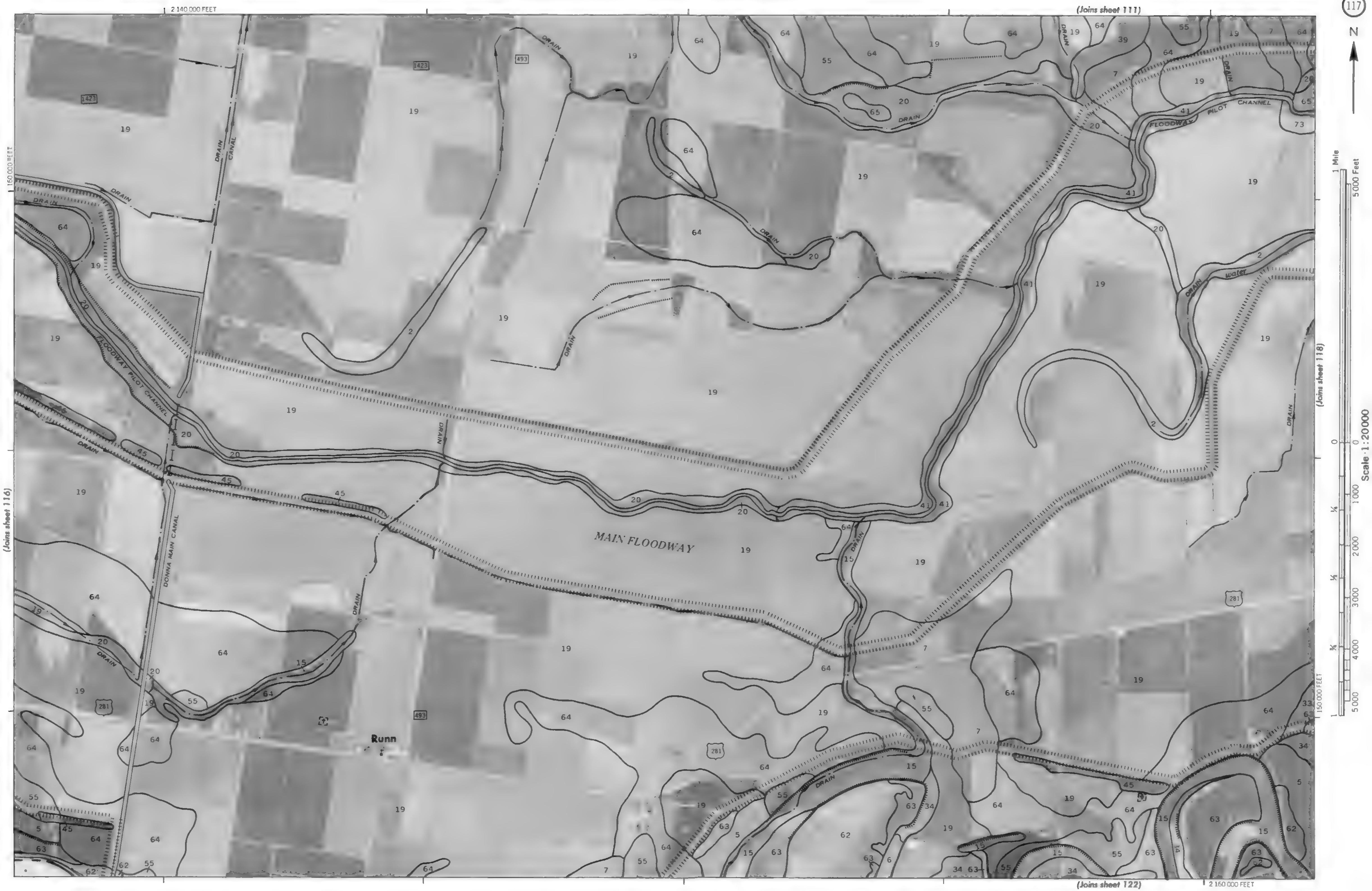
112
N
(Joins sheet 105)
(Joins sheet 111)
(Joins sheet 113)
(Joins sheet 118)
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
WESLACO
MISSOURI PACIFIC
TEXAS A&M RESEARCH AND EXTENSION CENTER
DRAIN
CANAL
MILE 7 NORTH ROAD
MILE 6 NORTH ROAD
MILE 5 NORTH ROAD
MILE 6 WEST ROAD
MILE 5½ WEST ROAD
MILE 4½ WEST ROAD
MILE 4 WEST ROAD
MILE 3½ WEST ROAD
MILE 2½ WEST ROAD
MILE 2 WEST ROAD
SANITARY LANDFILL
Llano Grande Lake
MAIN FLOODWAY
NORTH FLOODWAY


113
N
(Joins sheet 106)
(Joins sheet 119)
(Joins sheet 112)
2 190 000 FEET
2 210 000 FEET
180 000 FEET
165 000 FEET
MERCEDES
NORTH FLOODWAY
FLOODWAY PILOT CHANNEL
MAIN FLOODWAY
MERCEDES MAIN CANAL
Arroyo Anacuitas
Arroyo Colorado
CAMERON COUNTY
MILE 7 NORTH ROAD
MILE 1 EAST ROAD
MILE 1½ EAST ROAD
MILE 2½ EAST ROAD
MILE 3 EAST ROAD
CANAL
DRAIN
Water
Rio Grande
1 Mile
5000 Feet
Scale 1:20000


(Joins sheet 108)
(Joins inset)
(Joins sheet 115)
(Joins sh107)
(Joins upper left)
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
RIO GRANDE
TAMAULIPAS MEXICO
Hidalgo
U.S. BORDER
PORT OF ENTRY
Lake Tetuano
Abandoned Reservoir
Reservoir
SETTLING BASIN
(abandoned)
MISSOURI PACIFIC
PHARR SAN JUAN MAIN CANAL
CANAL
DRAIN
MC ALLEN
2 065 000 FEET


115
N
(Joins sheet 109)
(Joins sheet 116)
(Joins sheet 120)
(Joins sheet 114)
1 Mile
5000 Feet
Scale 1:20000
Fays Corner
RIO GRANDE
TAMAULIPAS
MEXICO
SANTA ANNA NATIONAL WILDLIFE REFUGE
CANAL
DRAIN


116
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
(Joins sheet 110)
(Joins sheet 115)
(Joins sheet 117)
(Joins sheet 121)
MAIN FLOODWAY
DONNA MAIN CANAL
MORNINGSIDE ROAD
TOWER ROAD
CANAL
DRAIN
3072
907
281
1423
North Lake
West Lake
SANTA ANNA NATIONAL WILDLIFE REFUGE
water
RIO GRANDE
TAMAULIPAS MEXICO
Reservoir
2
5
6
7
15
19
20
34
55
62
63
64
74



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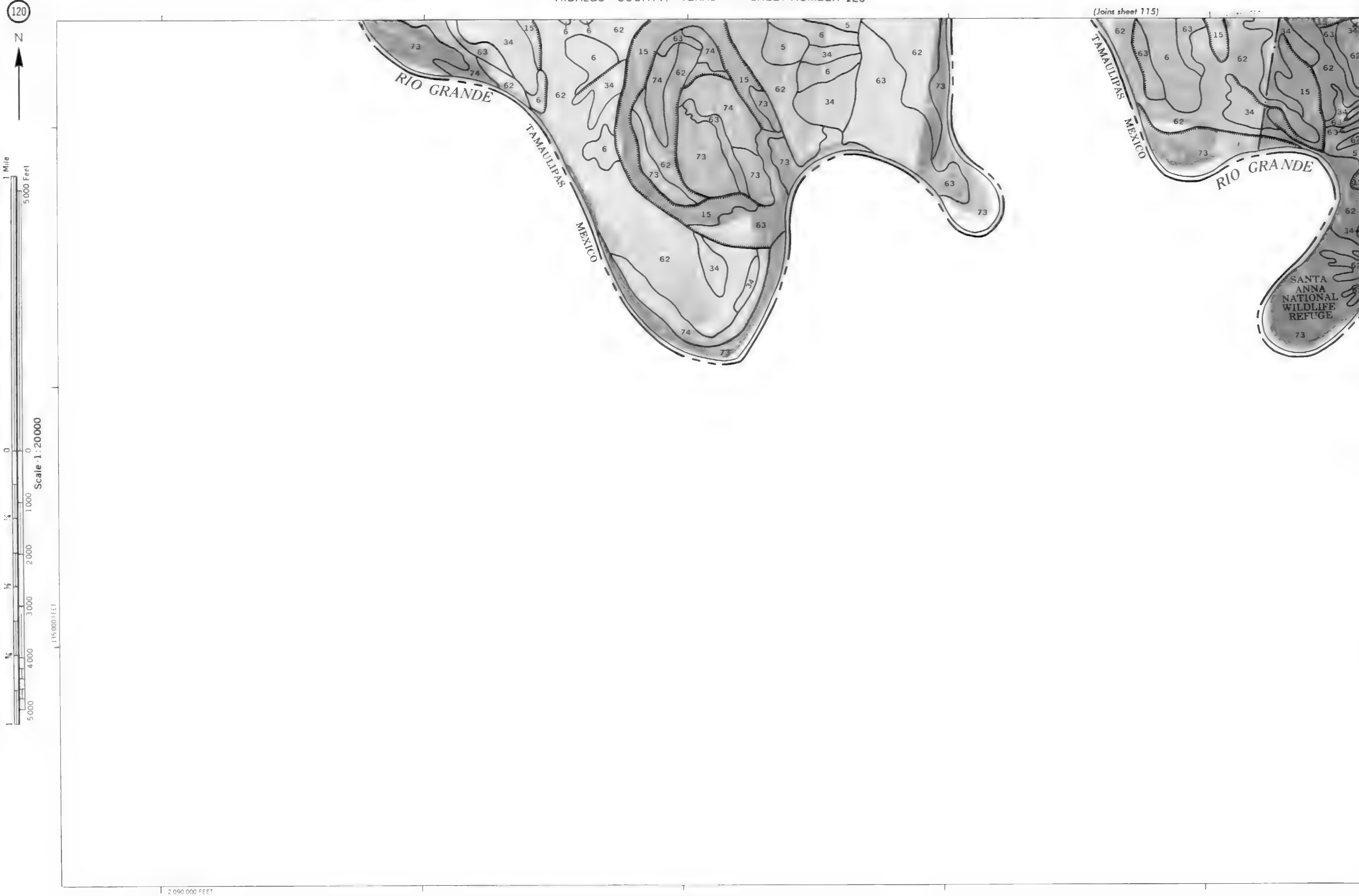
118
N
(Joins sheet 112)
(Joins sheet 117)
(Joins sheet 119)
(Joins sheet 123)
2 185 000 FEET
2 165 000 FEET
150 000 FEET
160 000 FEET
Scale 1:20000
1 Mile
5000 Feet
Llano Grande Lake
MAIN FLOODWAY
Progreso
Lion Lake
Airfield
DRAIN
CANAL
water
1015
281
88

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


120
N
(Joins sheet 115)
(Joins sheet 121)
RIO GRANDE
TAMAULIPAS
MEXICO
RIO GRANDE
TAMAULIPAS
MEXICO
SANTA ANNA NATIONAL WILDLIFE REFUGE
Scale 1:20000
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
135 000 FEET
145 000 FEET
2 090 000 FEET

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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122
N
(Joins sheet 117)
(Joins sheet 121)
(Joins sheet 123)
2 160 000 FEET
2 140 000 FEET
145 000 FEET
135 000 FEET
RIO GRANDE
RIO GRANDE
Reservoir
DRAIN
RETAMAL DAM
TAMAULIPAS
MEXICO
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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123
(Joins sheet 118)
(Joins sheet 122)
(Joins sheet 124)
2 165 000 FEET
145 000 FEET
135 000 FEET
2 185 000 FEET
N
RIO GRANDE
RIO GRANDE
TAMAULIPAS
MEXICO
U.S. BORDER
PORT OF ENTRY
Progreso District
Settling Basin
Progreso
Lakes
Moon Lake
Lion Lake
CANAL
1015
Scale 1:20000
1 Mile
5000 Feet

HIDALGO COUNTY, TEXAS — SHEET NUMBER 124

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.